

# Appendix C: Underfeed Stoker-Fired Boiler System Descriptions and Troubleshooting Diagrams

This TSG Appendix deals with identifying and solving potential coal quality-related problems that can be encountered in underfeed stoker-fired boiler systems. A general description of this system is included, but is limited to describing the major components (coal hopper, feeder distributor mechanism, coal-ash bed grates, damper controls) that make up a complete underfeed stoker-fired boiler system. For those interested, more detailed descriptions are provided in references 6, 7, and 8.

This Appendix includes a generalized block flow diagram of a complete overfeed stoker-fired boiler system that:

- identifies the specific components comprising the major subsystems of an overfeed stoker-fired boiler system
- logically presents the flow of coal, flue gas, and ash through the system
- helps determine the existence and location of subsystems and specific components comprising the system.

Following the block flow diagram is a component/symptom table that serves to identify:

- typical symptoms (problems) that may be encountered in the system
- the various components shown in the block flow diagram affected by these symptoms
- the logic diagram to determine whether the problem is due to operational procedures or to out-of-specification coal.

The Troubleshooting Logic Diagrams for this Appendix are presented next. However, before proceeding, the reader is encouraged to read Chapter 2 to understand the structure of each Appendix and how to apply these logic diagrams to diagnosing coal quality-related problems. The Glossary, List of Abbreviations, and References preceding the Appendixes should resolve any questions that arise regarding terminology and laboratory procedures.

## C1 System Description

The different types of underfeed stokers in use today all use the same principle of operation. Coal, fed into a hopper free flows down to a screw (Figure 3-1) or a mechanical ram (Figure 3-2) that forces the coal into a retort chamber. Small- and medium-sized boilers are equipped with single or double retort stokers. The feed ram or screw forces the coal from the hopper into the retort. During normal operation, the retort contains fresh coal that is continuously pushed out over the air-admitting grates by the secondary ram or pusher plates (blocks). The heat absorbed from the coal bed above and the action of the air being admitted through the grates cause the volatile gases to be distilled off and burn as they (the volatiles) pass through the coal bed.

The burning coal slowly moves from the retort toward the sides of the stoker over the grates. As the coal moves down the grates, the flame becomes short since the volatile gases have been consumed and only coke remains. Some coke finds its way to dump grates, and a damper admits air under the grates to further complete combustion before the ashes are dumped. The secondary ram or pusher plates (blocks) are adjustable so coal flow from the retort onto the grates can be varied to obtain optimum fuel-bed conditions.

Underfeed stokers are equipped with forced draft fans for maintaining sufficient air flow through the bed. The air pressure in the windbox under the stoker can be varied to meet load and coal-bed conditions. Air pressure can also be varied under different sections of the stoker to correct for irregular coal-bed conditions.

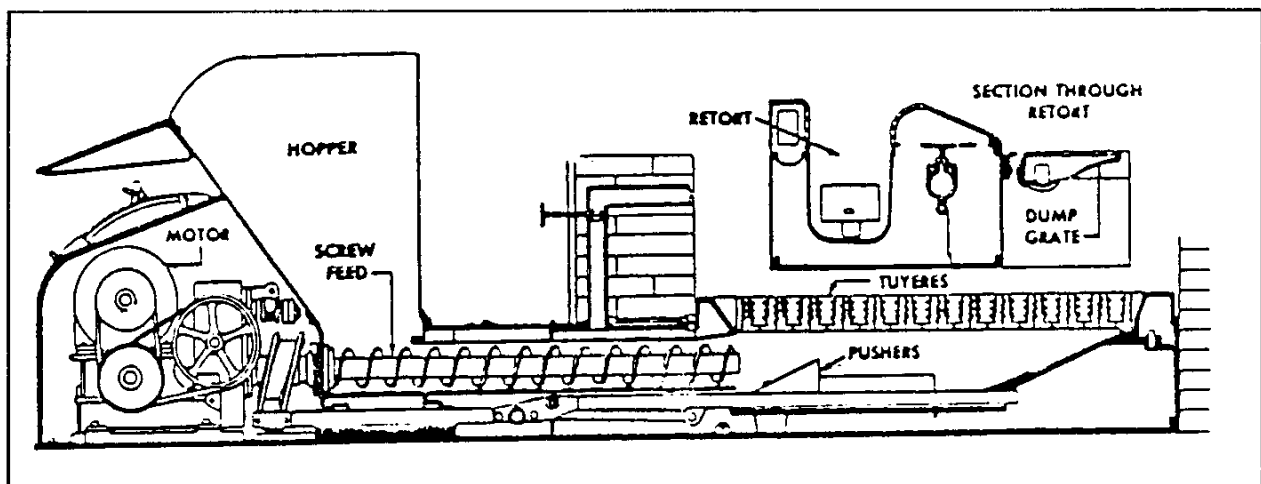


Figure 3-1. Screw-fed single-retort underfeed stoker.

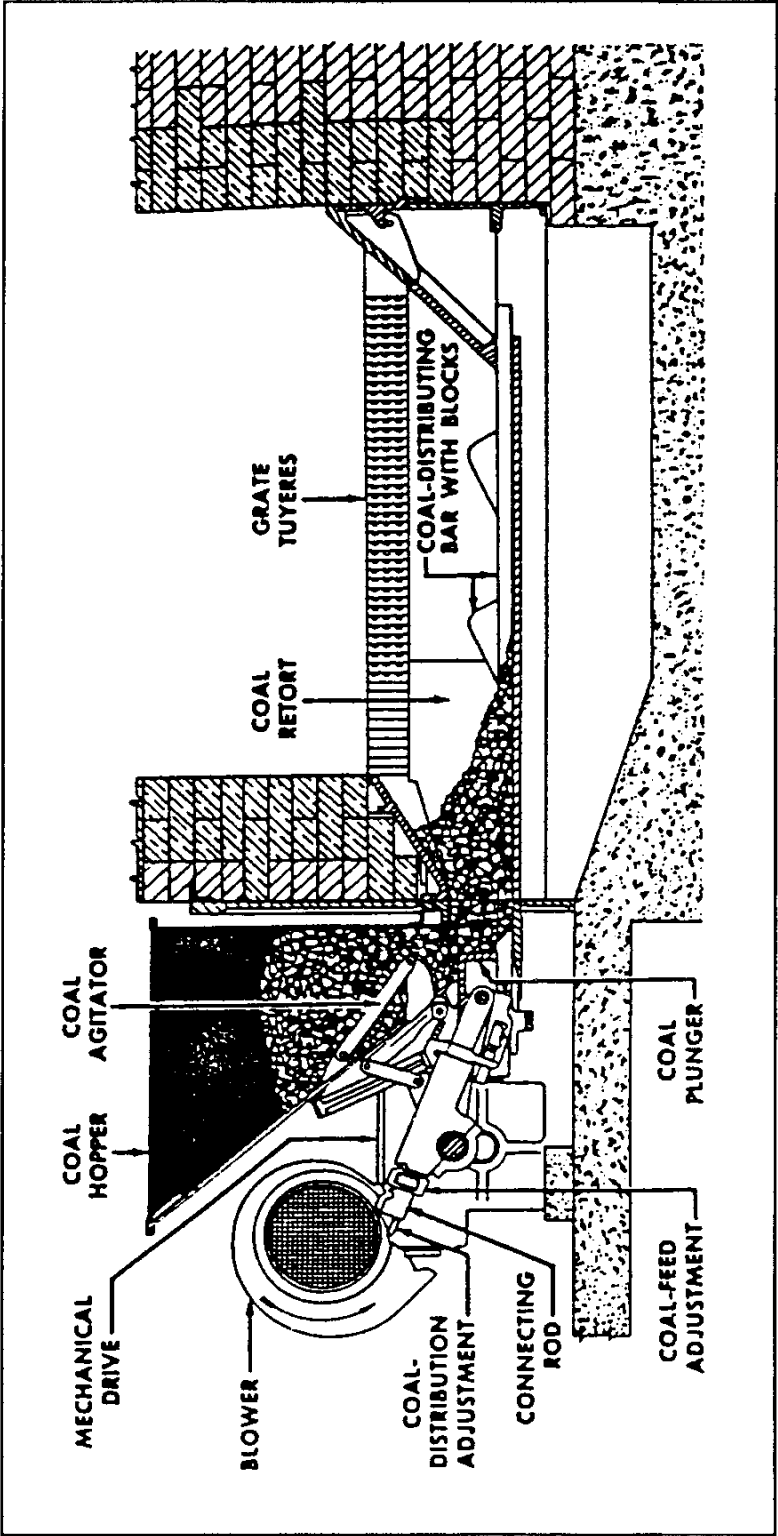


Figure 3-2. Single retort underfeed stoker.

Multiple-retort stokers (Figure 3-3) operate basically the same as single- or double-retort stokers. They are used under large boilers to obtain high combustion rates, and can have up to twelve retorts and grate sections arranged side-by-side to make the required stoker width. A ram feeder supplies each retort with coal. These stokers are inclined at 25 to 30 degrees from the rams toward the ash-discharge end. They are also equipped with secondary rams or pusher plates (blocks) that, together with the effects of gravity produced by inclining the stoker, cause the coal to move toward the rear or refuse discharge. Large multiple-retort stokers have mechanical devices for discharging refuse from the furnace. Dumping grates receive refuse as it comes from extension grates. When a sufficient amount has been collected, the grates are lowered and the refuse is dumped into the ash pit.

Rotary ash discharge may also be used to regulate the rate of refuse discharged from multiple-retort underfeed stokers. Stokers using this type of ash discharge are referred to as clinker grinders. They consist of two rollers with protruding lugs installed in place of dumping grates. These rollers are operated at a variable speed to discharge refuse continuously.

## C2 Block Flow Diagram

The underfeed stoker-fired boiler system has been divided into 15 specific subsystems or components (the performance of which can be significantly impacted by coal quality) sequentially arranged to show:

- coal flow through the coal handling equipment

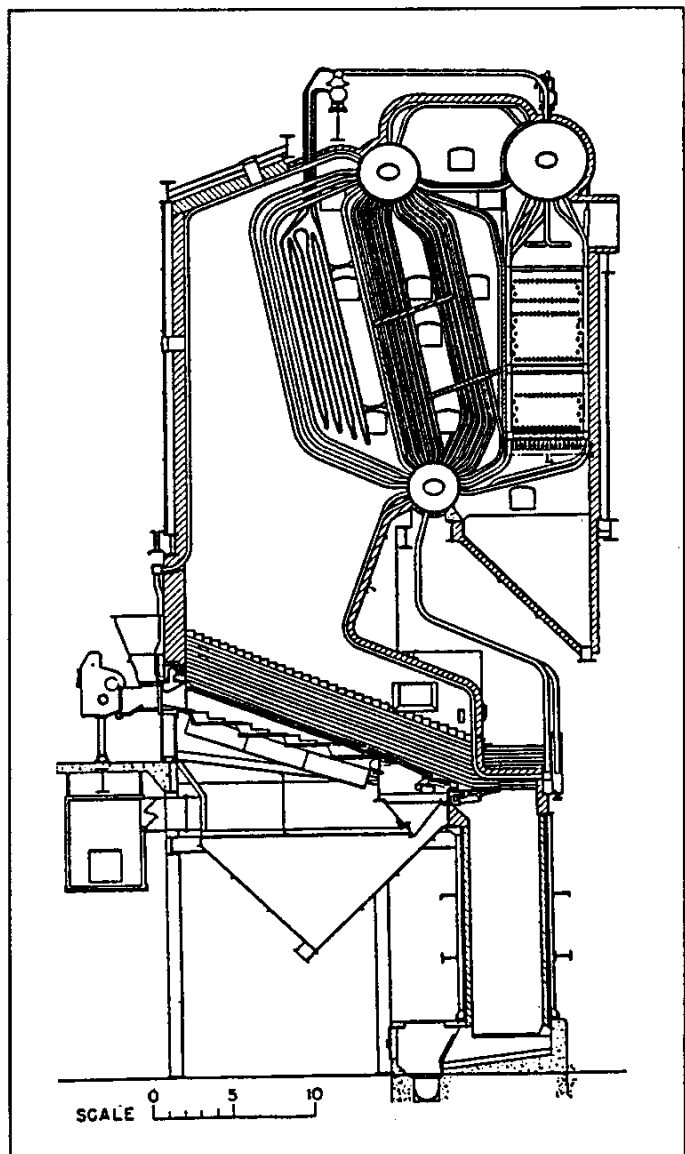


Figure 3-3. Multiple retort stoker boiler.

- flue gas flow through the boiler/components, flyash recycle, and the induced draft fan and chimney/stack
- ash discharge to the ash hopper/pit.

These specific components are identified in Figure 3-4. The first six components have been grouped collectively under a category entitled coal-handling equipment. The coal-handling equipment includes all components that process the coal from its delivery on site to the coal regulating gate. It includes equipment that, depending on plant design, may include:

- coal reclaim systems such as belt feeders, vibrating feeders, screw feeders, and reciprocating feeders
- coal feed conveyors such as belt conveyors, screw conveyors, bucket conveyors, redler conveyors, and chutes
- components that store the coal such as bunkers and hoppers
- coal feeders that transport coal to the stoker coal hopper
- ram or screw feeder that forces coal into the retort chamber.

The next four components have been loosely grouped under the category entitled Boiler/components. Again, it includes equipment that depending on plant design may include:

- forced draft fan
- grates—specifically stationery and dumping grates
- refractory surfaces
- heat transfer surfaces (boiler tubes, water walls and baffle).

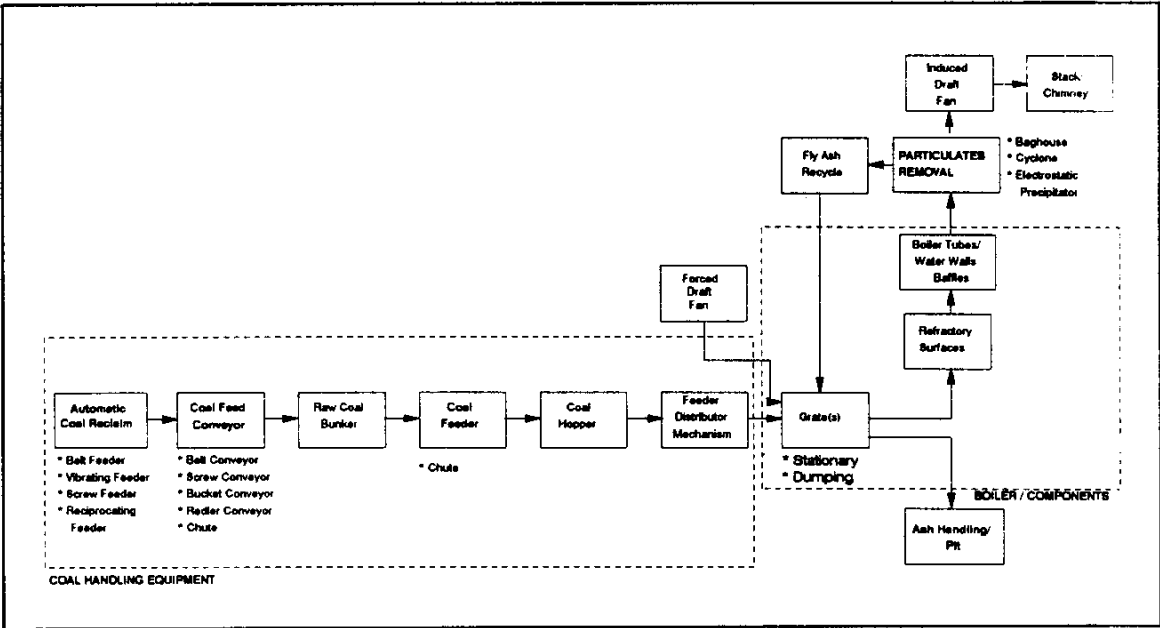


Figure 3-4. Underfeed stoker-fired boiler system components block flow diagram.

The next two blocks represent the flyash recycle and the particulate removal subsystem. Three particulate removal options separately or in combination will be considered: cyclones, electrostatic precipitators, and baghouses.

The next subsystem identified in the block flow diagram is the fan subsystem. Underfeed stoker-fired boiler systems use a number of fans to move air and flue gas. The major fan types addressed in the Guide include:

- forced draft (FD) fans, which supply undergrate air
- induced draft (ID) fans, which withdraw flue gas from the furnace and balance furnace pressure.

All the fans can be impacted by changes in coal quality.

The final subsystems addressed in the Guide include those components supplied to handle ash. Specific components include the chimney/stack and the ash hopper/ pit.

**C3 Troubleshooting Logic**

The component/symptom Guide table (Figure 3-5) serves to identify:

- Typical symptoms (problems) that may be encountered in underfeed stoker--fired boiler systems. These symptoms are arranged horizontally along the top of the table
- The various components shown in the block flow diagram affected by these symptoms. These components are listed down the left hand side of the table in the same logical fashion as they are arranged in the block flow diagram.
- The logic diagrams.

The remainder of this Appendix consists of 92 logic diagrams, arranged by component and by all the symptoms that can affect that component.

| FIGURE 3-5 (Part 1): UNDERFEED STOKER - COMPONENT/SYMPTOM GUIDE |             |                 |                       |                 |           |             |               |                |                 |                |                        |          |                |                    |
|---|-------------|-----------------|-----------------------|-----------------|-----------|-------------|---------------|----------------|-----------------|----------------|------------------------|----------|----------------|--------------------|
| COMPONENT   | EXCESS WEAR | PLUGGED SYMPTOM | INSUFFICIENT CAPACITY | ERRATIC FEEDING | CORROSION | SEGREGATION | PRESSURE DROP | UNEVEN ASH BED | UNEVEN COAL BED | UNEVEN BURNING | WARPED, BURNT, CRACKED | CLINKERS | CARBON BURNOUT | REDUCED EFFICIENCY |
| COAL HANDLING EQUIPMENT   |             |                 |                       |                 |           |             |               |                |                 |                |                        |          |                |                    |
| Automatic Coal Reclaim  |             |                 |                       |                 |           |             |               |                |                 |                |                        |          |                |                    |
| 1) Belt Feeder  | •           | •               | •                     | •               | •         | •           | •             | •              | •               | •              | •                      | •        | •              | •                  |
| 2) Vibrating Feeder   | •           | •               | •                     | •               | •         | •           | •             | •              | •               | •              | •                      | •        | •              | •                  |
| 3) Screw Feeder   | •           | •               | •                     | •               | •         | •           | •             | •              | •               | •              | •                      | •        | •              | •                  |
| 4) Reciprocating Feeder   | •           | •               | •                     | •               | •         | •           | •             | •              | •               | •              | •                      | •        | •              | •                  |
| Coal Feed Conveyor  |             |                 |                       |                 |           |             |               |                |                 |                |                        |          |                |                    |
| 1) Belt Conveyor  | •           | •               | •                     | •               | •         | •           | •             | •              | •               | •              | •                      | •        | •              | •                  |
| 2) Screw Conveyor   | •           | •               | •                     | •               | •         | •           | •             | •              | •               | •              | •                      | •        | •              | •                  |
| 3) Bucket Conveyor  | •           | •               | •                     | •               | •         | •           | •             | •              | •               | •              | •                      | •        | •              | •                  |
| 4) Redler Conveyor  | •           | •               | •                     | •               | •         | •           | •             | •              | •               | •              | •                      | •        | •              | •                  |
| 5) Chute  | •           | •               | •                     | •               | •         | •           | •             | •              | •               | •              | •                      | •        | •              | •                  |

Figure 3-5. Underfeed stoker—component symptom guide (part 1).

| FIGURE 3-5 (Part 2): UNDERFEED STOKER - COMPONENT/SYMPTOM GUIDE |             |                 |                       |                 |           |             |               |                |                 |                |                        |          |                |                    |
|---|-------------|-----------------|-----------------------|-----------------|-----------|-------------|---------------|----------------|-----------------|----------------|------------------------|----------|----------------|--------------------|
| COMPONENT   | EXCESS WEAR | PLUGGED SYMPTOM | INSUFFICIENT CAPACITY | ERRATIC FEEDING | CORROSION | SEGREGATION | PRESSURE DROP | UNEVEN ASH BED | UNEVEN COAL BED | UNEVEN BURNING | WARPED, BURNT, CRACKED | CLINKERS | CARBON BURNOUT | REDUCED EFFICIENCY |
| COAL HANDLING EQUIP. (CONT)                                     |             |                 |                       |                 |           |             |               |                |                 |                |                        |          |                |                    |
| Coal Feeders  |             |                 |                       |                 |           |             |               |                |                 |                |                        |          |                |                    |
| Chute   | •           | •               | •                     | •               | •         | •           | •             | •              | •               | •              | •                      | •        | •              | •                  |
| Coal Bunker   | •           | •               | •                     | •               | •         | •           | •             | •              | •               | •              | •                      | •        | •              | •                  |
| Coal Hopper   | •           | •               | •                     | •               | •         | •           | •             | •              | •               | •              | •                      | •        | •              | •                  |
| Feeder Distributor Mechanism                                    | •           | •               | •                     | •               | •         | •           | •             | •              | •               | •              | •                      | •        | •              | •                  |
| BOILER / COMPONENTS   |             |                 |                       |                 |           |             |               |                |                 |                |                        |          |                |                    |
| Boiler  | •           | •               | •                     | •               | •         | •           | •             | •              | •               | •              | •                      | •        | •              | •                  |
| 1) Grates   | •           | •               | •                     | •               | •         | •           | •             | •              | •               | •              | •                      | •        | •              | •                  |
| 2) Refractory Surfaces  | •           | •               | •                     | •               | •         | •           | •             | •              | •               | •              | •                      | •        | •              | •                  |
| 3) Boiler Tubes/Water Walls                                     | •           | •               | •                     | •               | •         | •           | •             | •              | •               | •              | •                      | •        | •              | •                  |
| 4) Baffles  | •           | •               | •                     | •               | •         | •           | •             | •              | •               | •              | •                      | •        | •              | •                  |

Figure 3-5. Underfeed stoker—component symptom guide (part 2).

| FIGURE 3-5 (Part 3): UNDERFEED STOKER - COMPONENTS/SYMPTOM GUIDE |             |              |                       |                 |           |             |               |                |                 |                |                        |          |                  |                    |         |         |                   |         |                              |               |   |      |
|--|-------------|--------------|-----------------------|-----------------|-----------|-------------|---------------|----------------|-----------------|----------------|------------------------|----------|------------------|--------------------|---------|---------|-------------------|---------|------------------------------|---------------|---|------|
| COMPONENT  | EXCESS WEAR | PLUGGAS/SYMP | INSUFFICIENT CAPACITY | ERRATIC FEEDING | CORROSION | SEGREGATION | PRESSURE DROP | UNEVEN ASH BED | UNEVEN COAL BED | UNEVEN BURNING | WARPED, BURNT, CRACKED | CLINKERS | CARBON BURNT OUT | REDUCED EFFICIENCY | SMOKING | EROSION | SLAGGING/SPALLING | FOULING | EXCESS PARTICULATE EMISSIONS | SO2 EMISSIONS |   |      |
| FANS   |             |              |                       |                 |           |             |               |                |                 |                |                        |          |                  |                    |         |         |                   |         |                              |               |   |      |
| 1) Forced Draft  |             | ●            | 3-76                  |                 |           |             |               |                |                 |                |                        |          |                  | ●                  | 3-77    |         |                   |         |                              |               |   |      |
| 2) Induced Draft   |             | ●            | 3-78                  | ●               | 3-79      |             |               |                |                 |                |                        |          |                  | ●                  | 3-80    | ●       | 3-81              |         |                              |               |   |      |
| PARTICULATE REMOVAL  |             |              |                       |                 |           |             |               |                |                 |                |                        |          |                  |                    |         |         |                   |         |                              |               |   |      |
| 1) Baghouse  |             |              |                       |                 |           |             |               |                |                 |                |                        | ●        | 3-82             |                    |         |         |                   |         | ●                            | 3-83          |   |      |
| 2) Cyclone   |             |              |                       |                 |           |             |               |                |                 |                |                        | ●        | 3-84             |                    | ●       | 3-85    |                   |         | ●                            | 3-86          |   |      |
| 3) Electrostatic Precipitator                                    |             |              |                       |                 |           |             |               |                |                 |                |                        | ●        | 3-87             |                    | ●       | 3-88    |                   |         | ●                            | 3-89          |   |      |
| ASH HANDLING   |             |              |                       |                 |           |             |               |                |                 |                |                        |          |                  |                    |         |         |                   |         |                              |               |   |      |
| 1) Fly Ash Recycle   |             |              |                       |                 |           |             |               |                |                 |                |                        |          | ●                | 3-90               |         |         |                   |         |                              |               |   |      |
| 2) Ash Hopper/Pit  |             |              |                       |                 |           |             |               |                |                 |                |                        | ●        | 3-91             | ●                  | 3-92    |         |                   |         |                              |               |   |      |
| Stack/Chimney  |             |              |                       | ●               | 3-93      |             |               |                |                 |                |                        | ●        | 3-94             |                    | ●       | 3-95    |                   |         | ●                            | 3-96          | ● | 3-97 |

Figure 3-5. Underfeed stoker—component symptom guide (part 3).



FIGURE 3-6: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Excess Wear Of The Automatic Coal Reclaim  
(Belt Feeder)

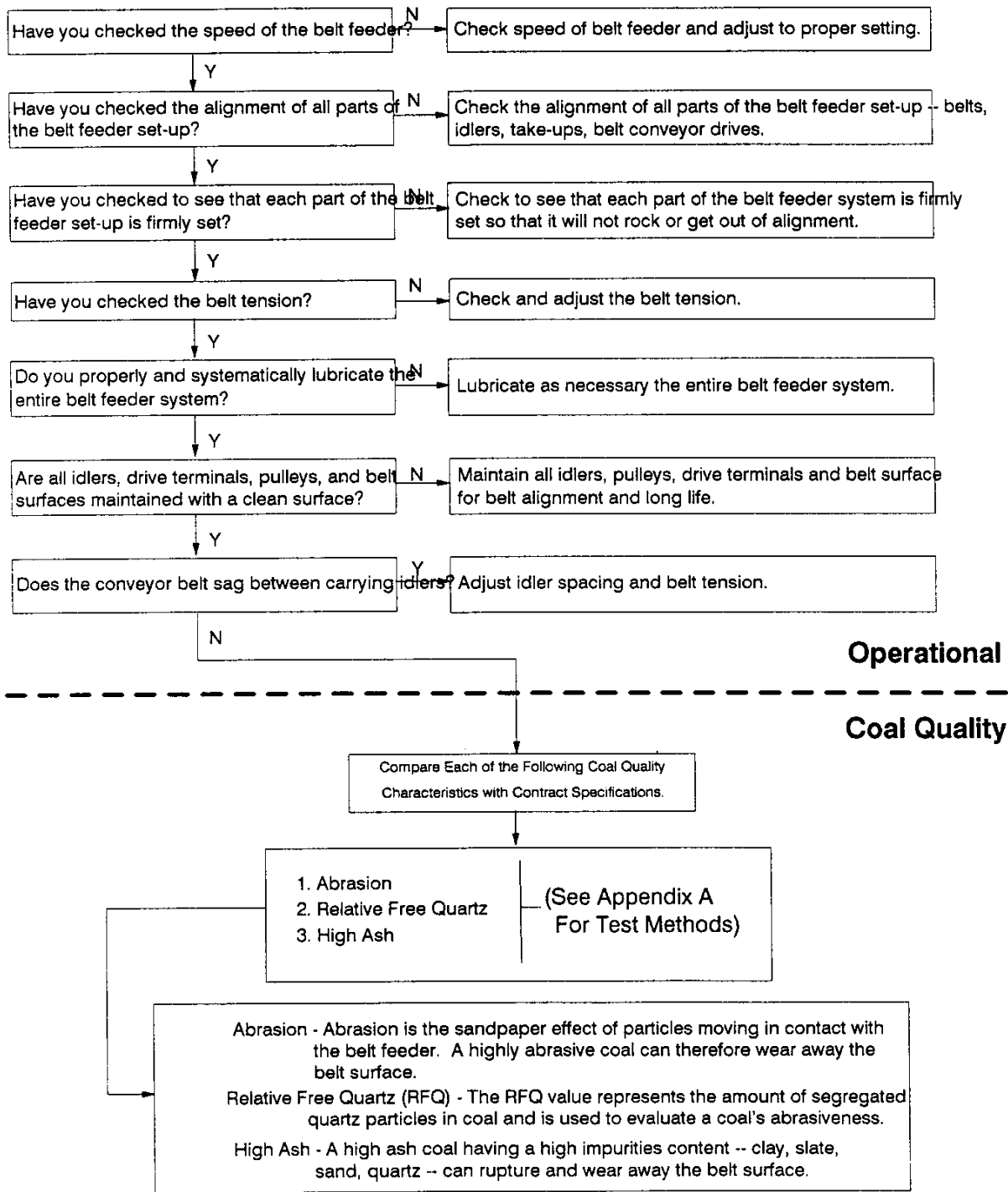


FIG3-6r/1

**FIGURE 3-7: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM**  
**For Pluggage In The Automatic Coal Reclaim**  
**(Belt Feeder)**

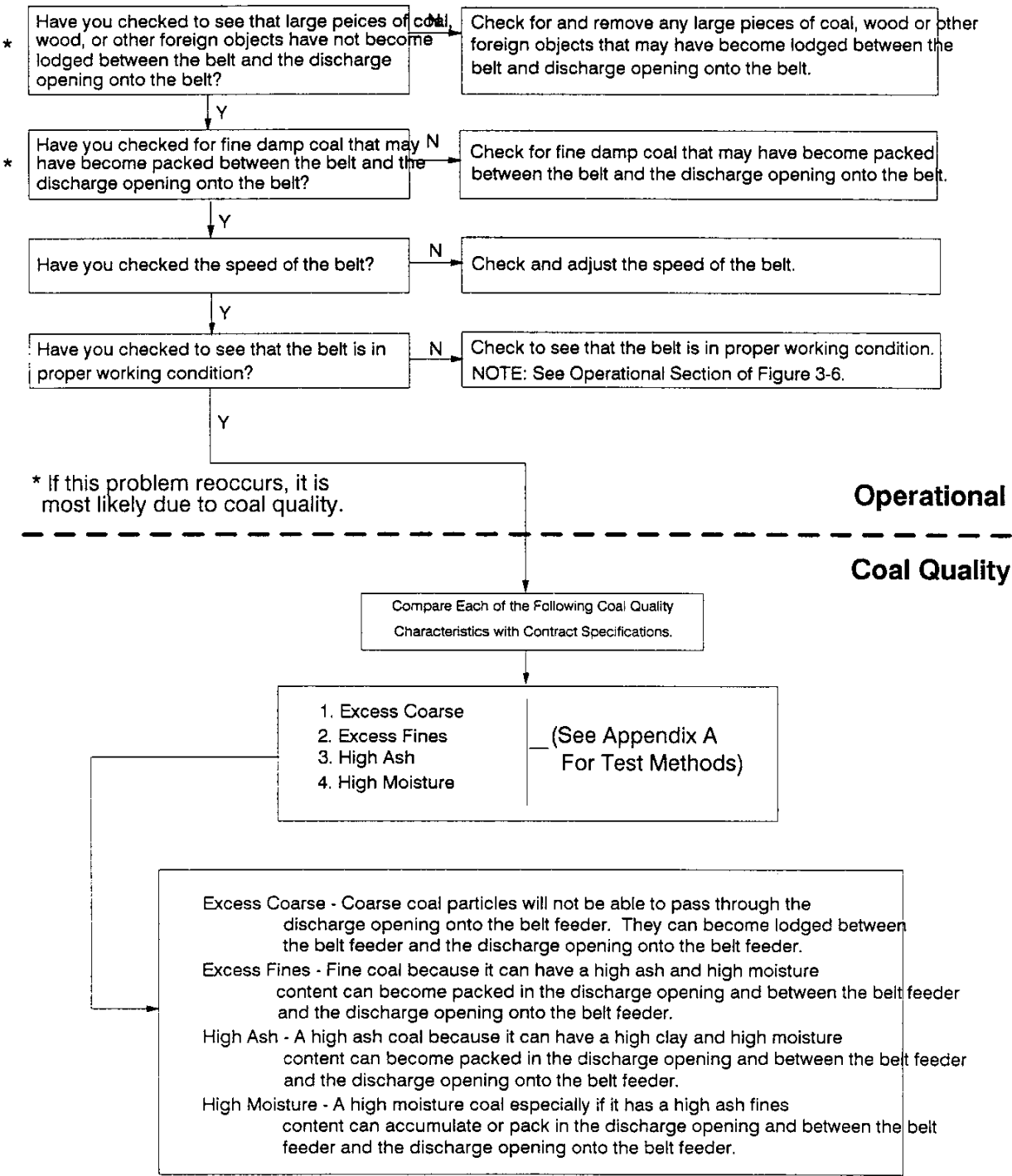


FIG3-7n/1

FIGURE 3-8: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Insufficient Capacity Of The Automatic Coal Reclaim  
(Belt Feeder)

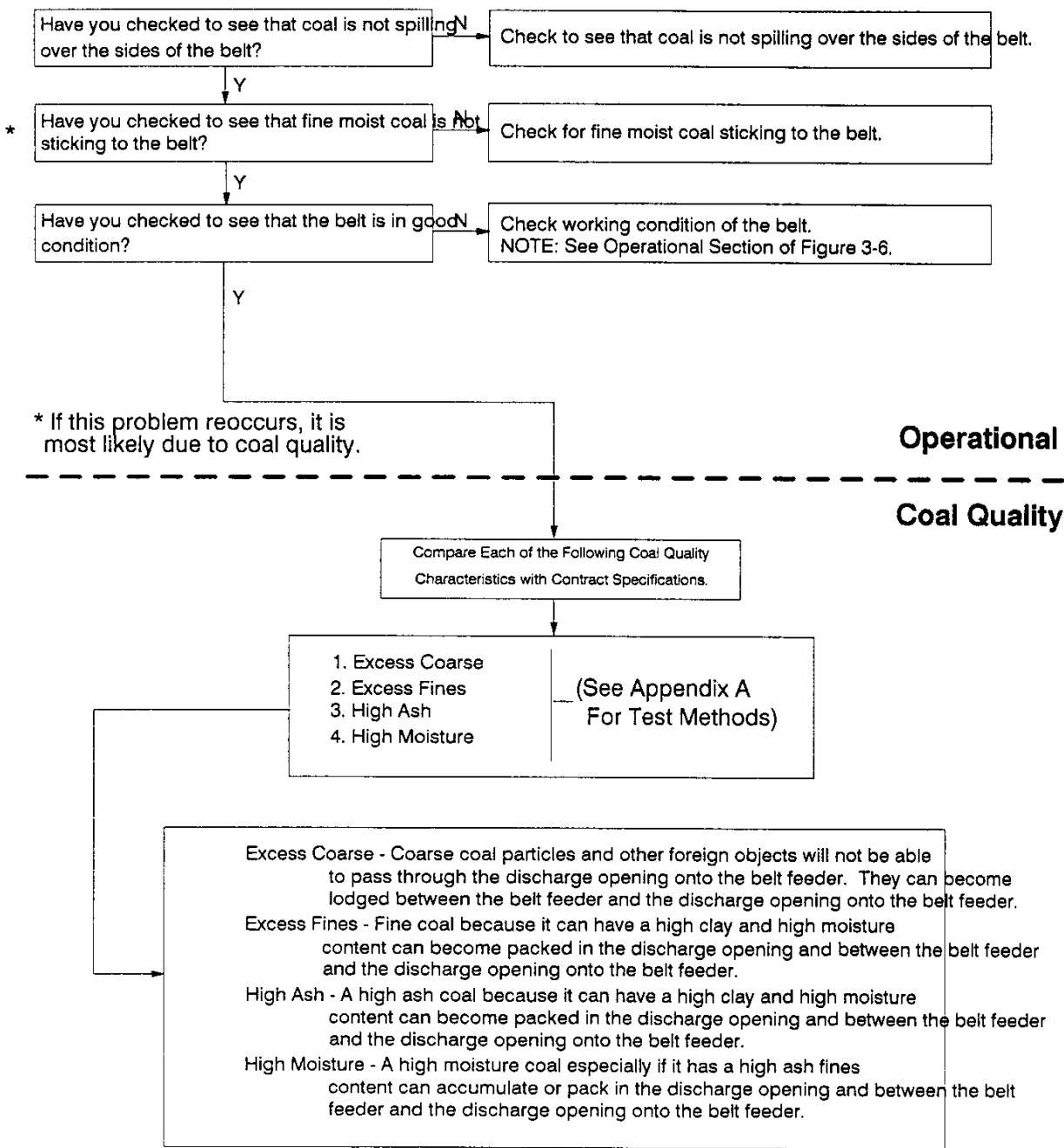


FIG3-8n/1

**FIGURE 3-9: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM**  
**For Erratic Feeding From The Automatic Coal Reclaim**  
**(Belt Feeder)**

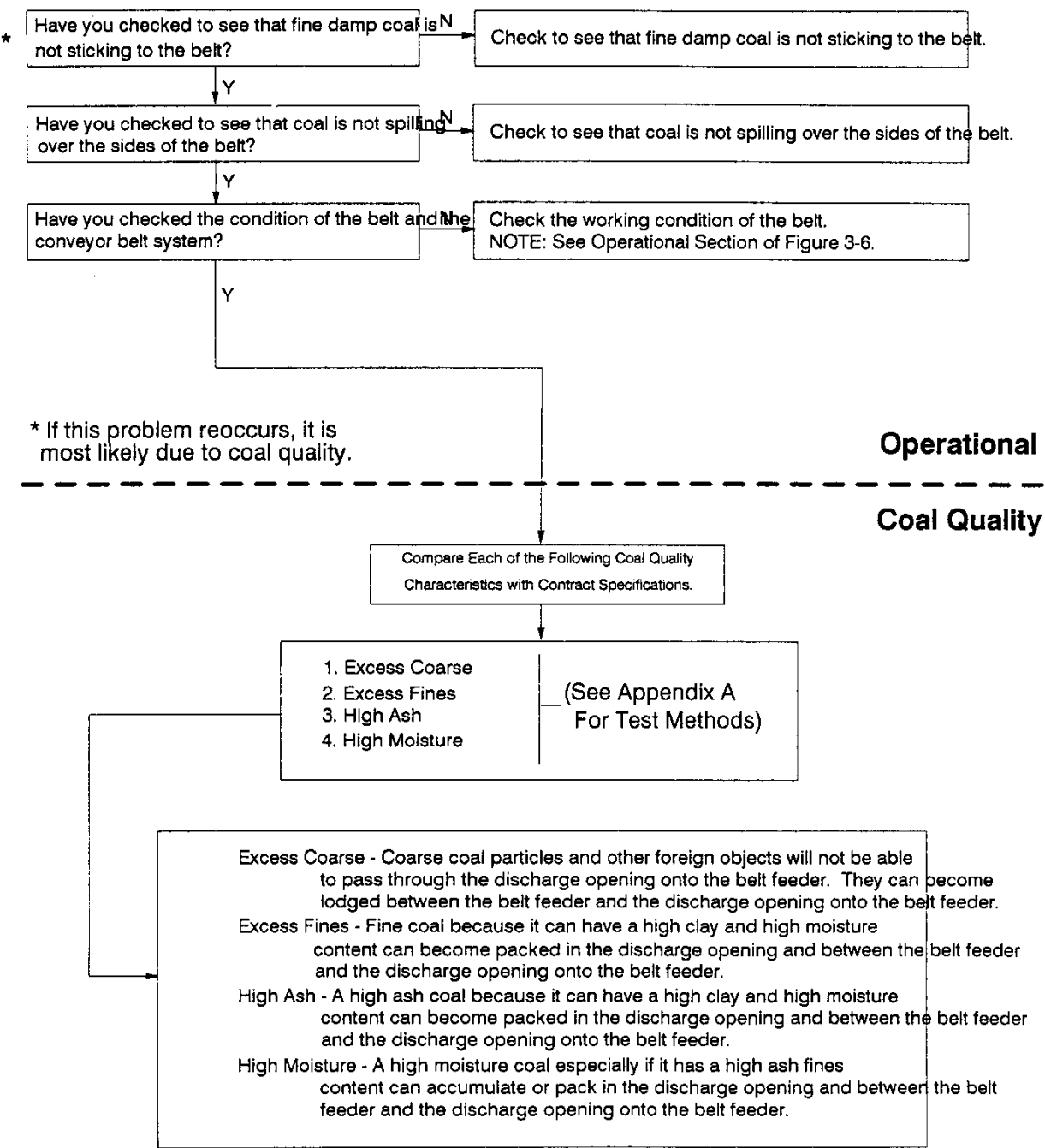
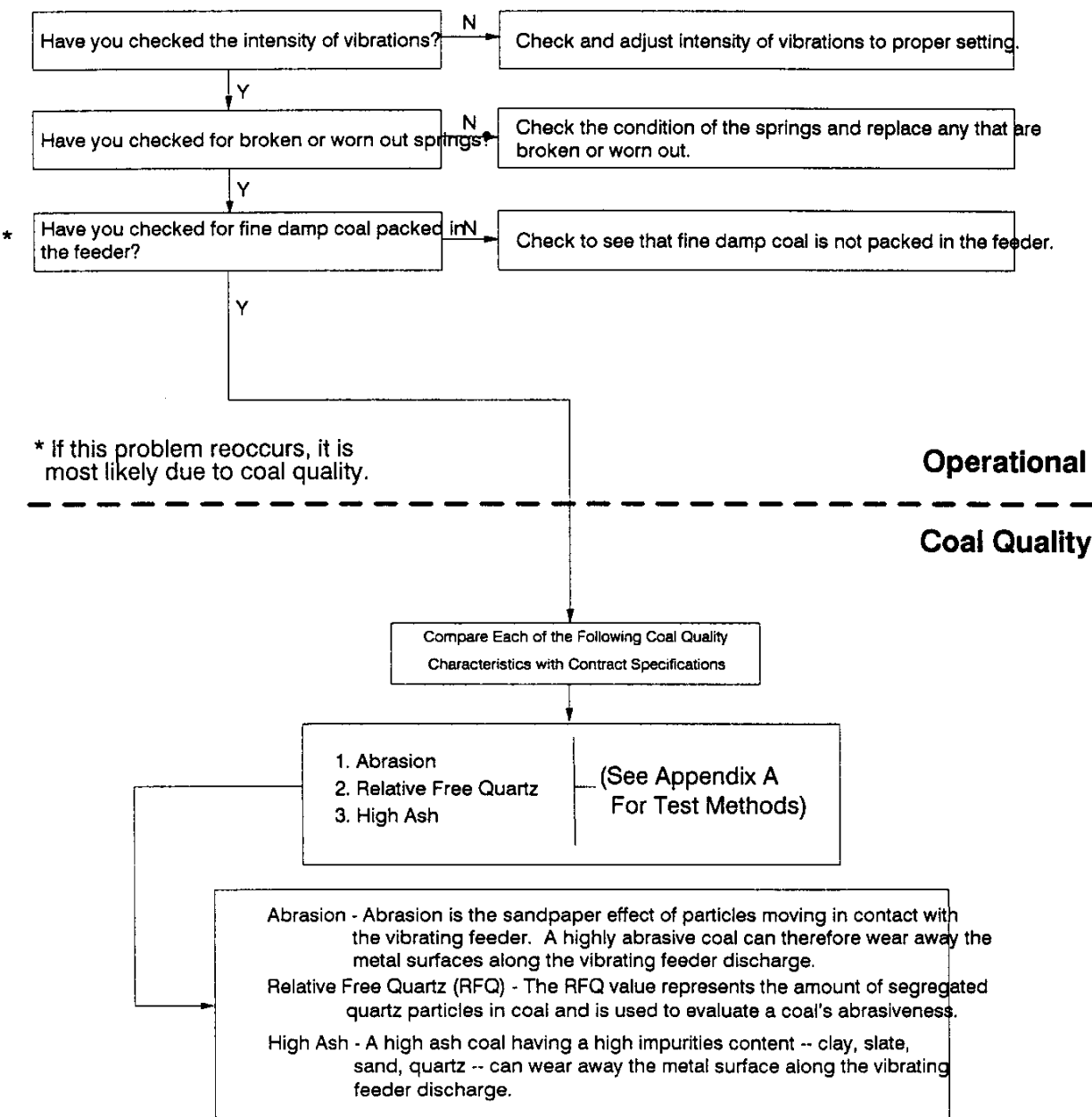


FIG3-9v1

FIGURE 3-10: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Excess Wear Of The Automatic Coal Reclaim  
(Vibrating Feeder)



**FIGURE 3-11: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM**  
**For Pluggage In The Automatic Coal Reclaim**  
**(Vibrating Feeder)**

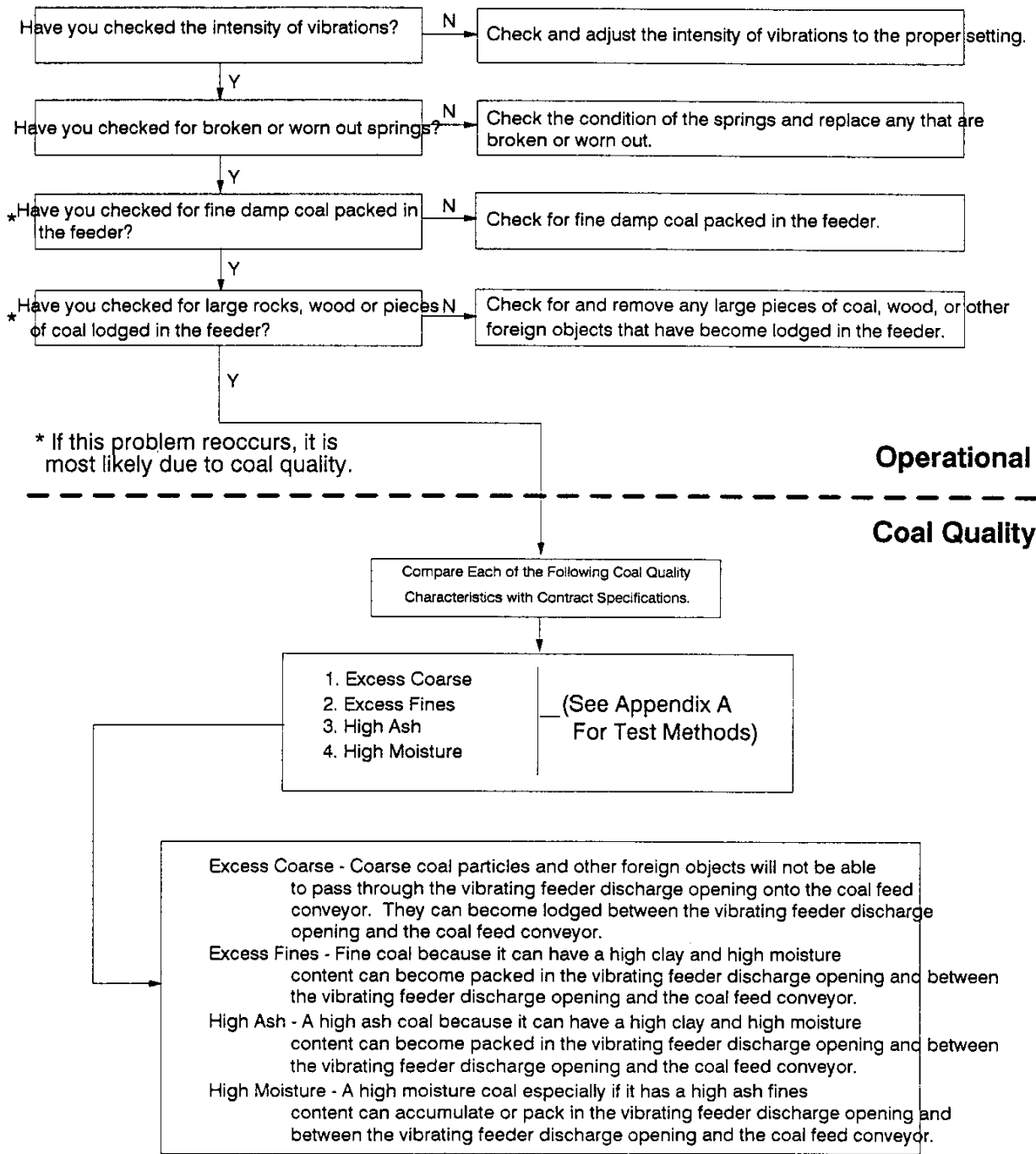


FIG3-11N/1

**FIGURE 3-12: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM**  
**For Insufficient Capacity Of The Automatic Coal Reclaim**  
**(Vibrating Feeder)**

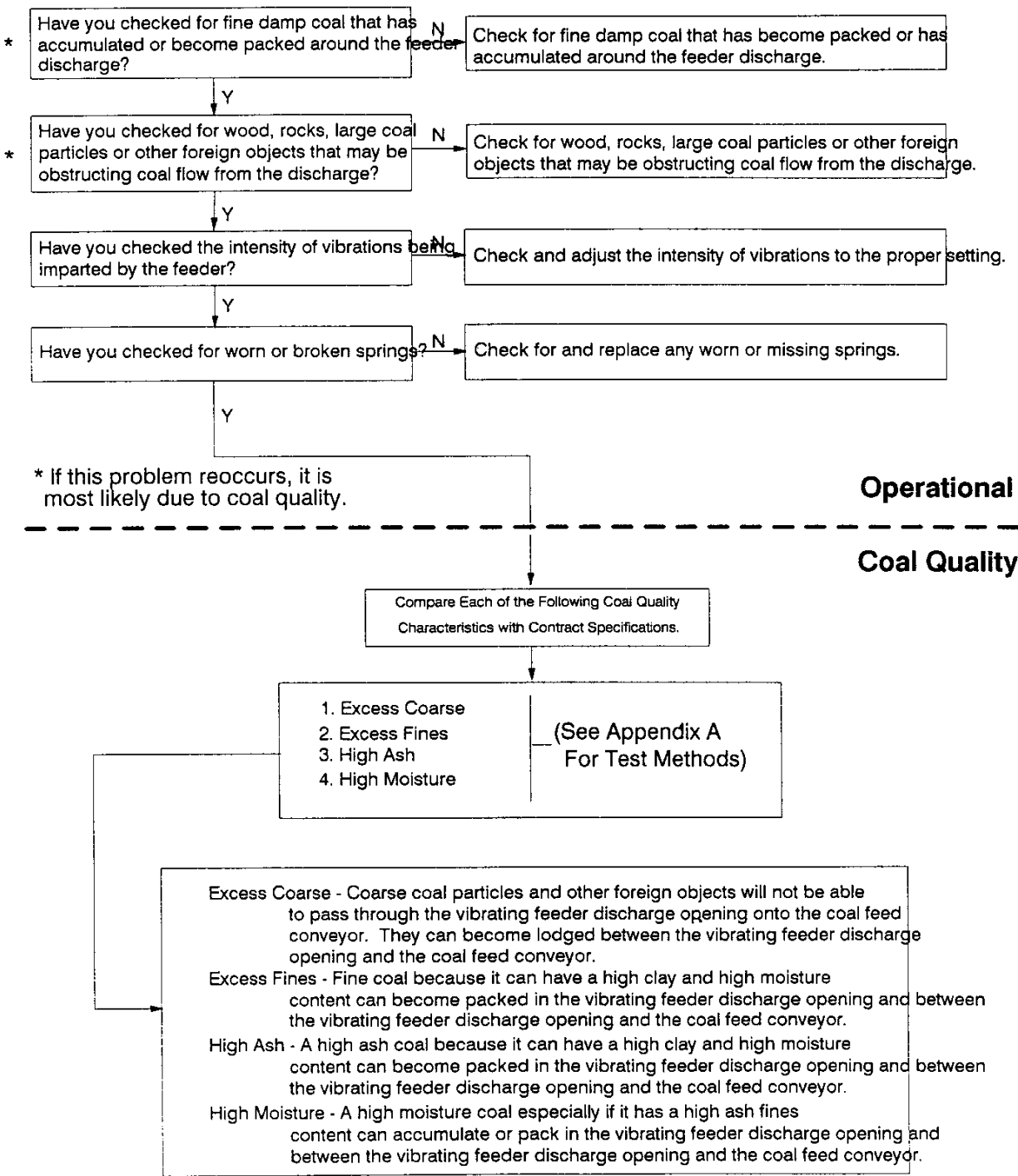


FIG3-12N/1

**FIGURE 3-13: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM**  
**For Erratic Feeding From The Automatic Coal Reclaim**  
**(Vibrating Feeder)**

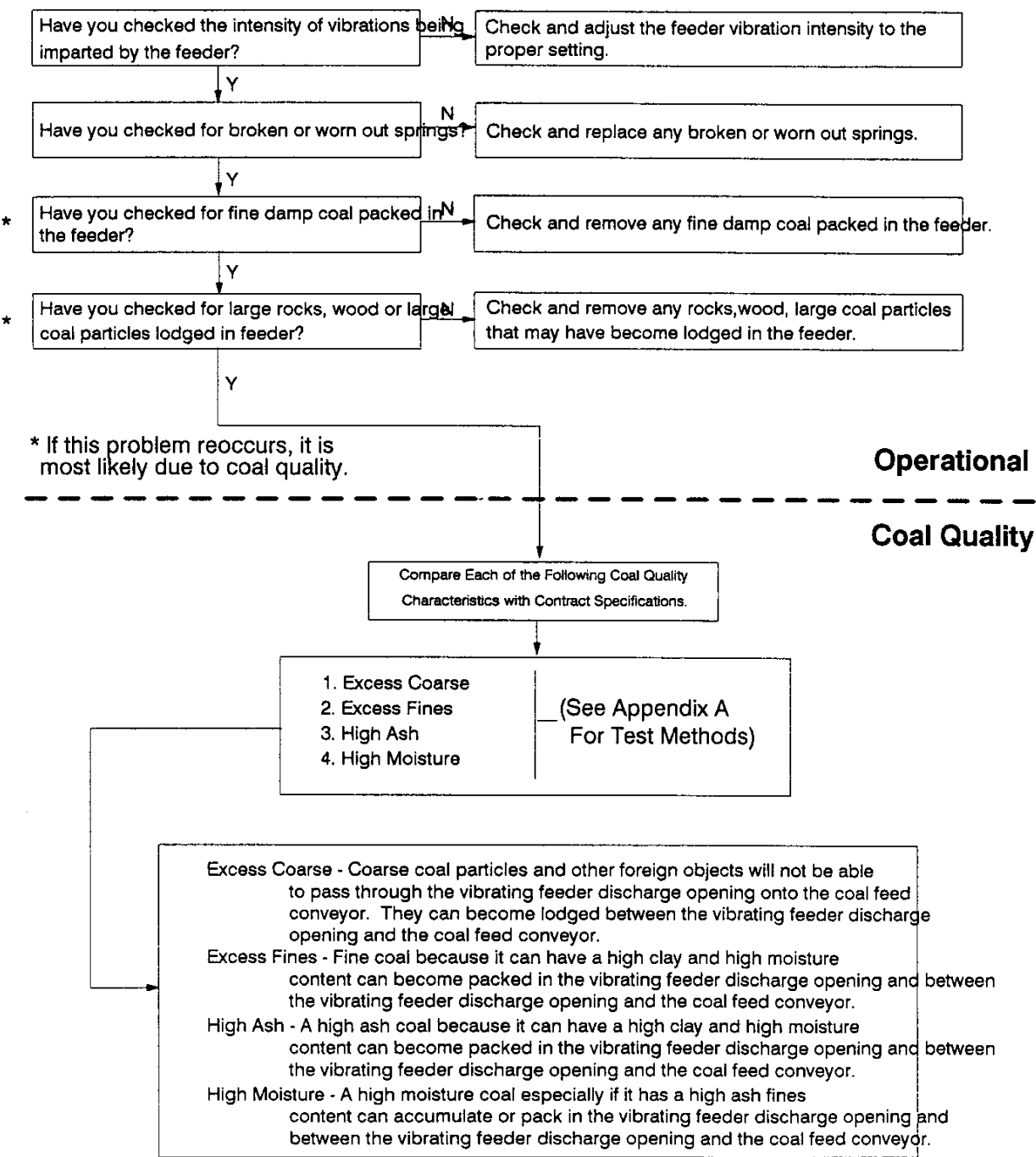


FIG3-13v1



FIGURE 3-14: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Excess Wear Of The Automatic Coal Reclaim  
(Screw Feeder)

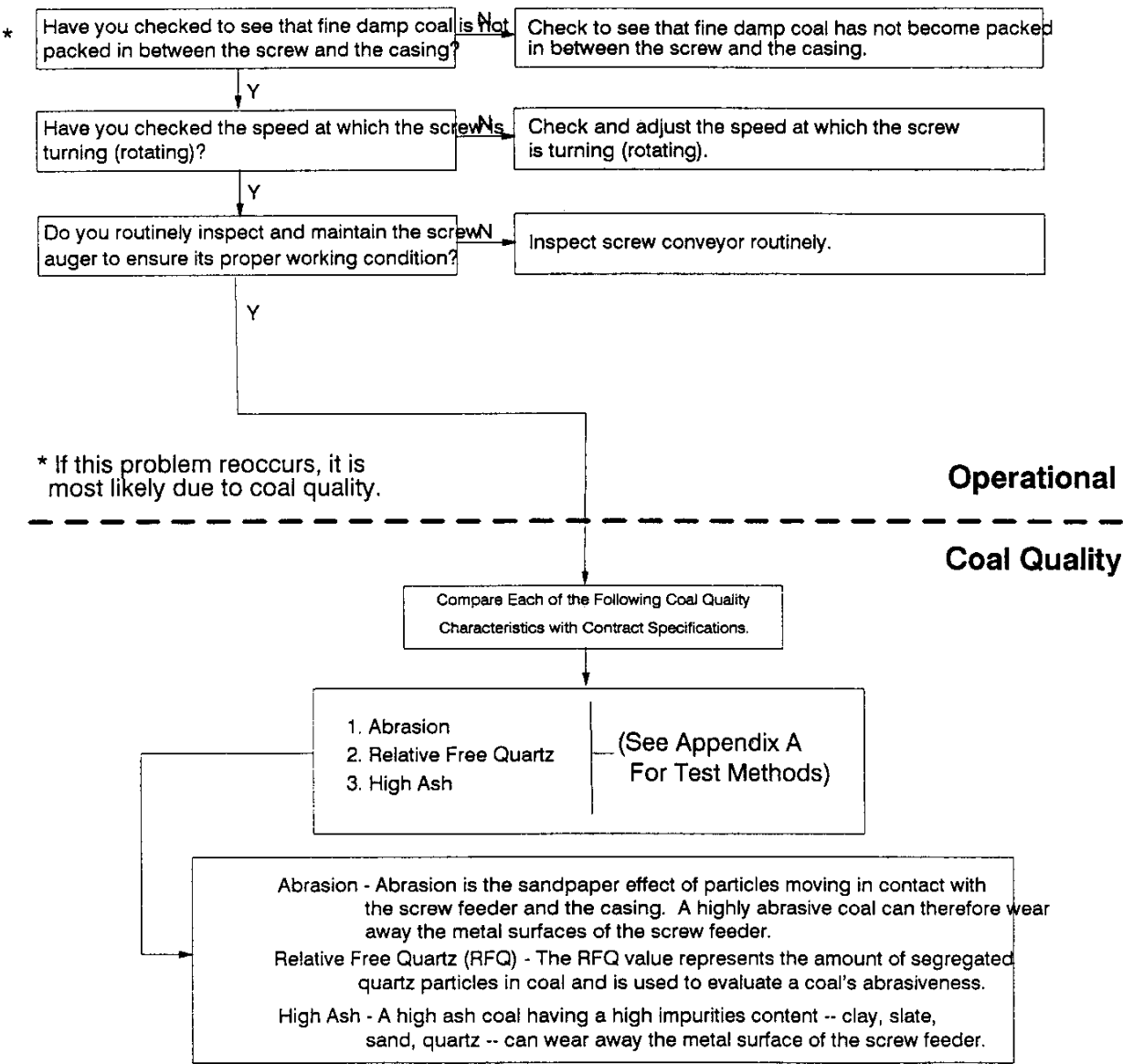


FIG3-14v1

**FIGURE 3-15: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM**  
**For Pluggage In The Automatic Coal Reclaim**  
**(Screw Feeder)**

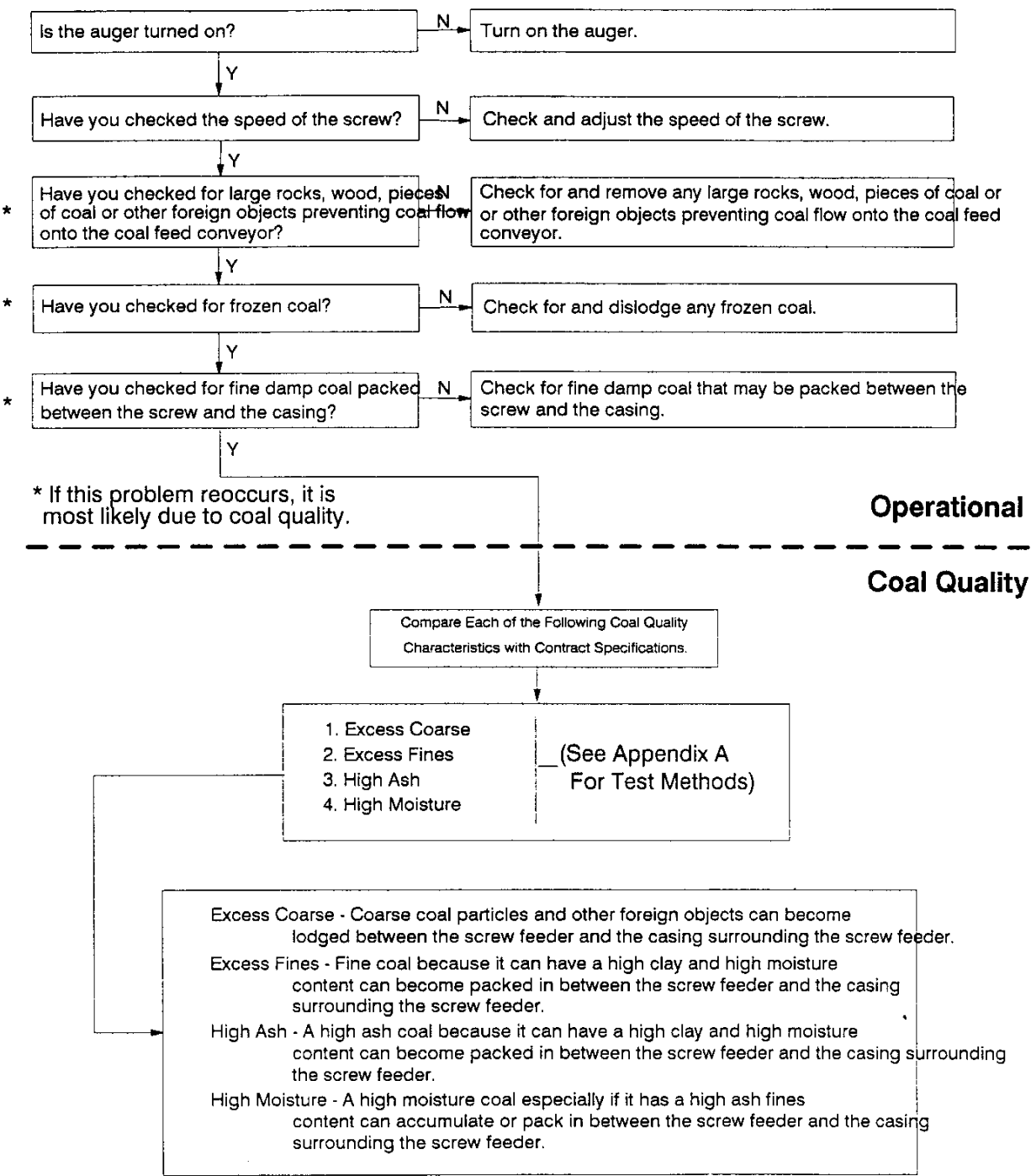


FIG3-15N/1

FIGURE 3-16: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Insufficient Capacity Of The Automatic Coal Reclaim  
(Screw Feeder)

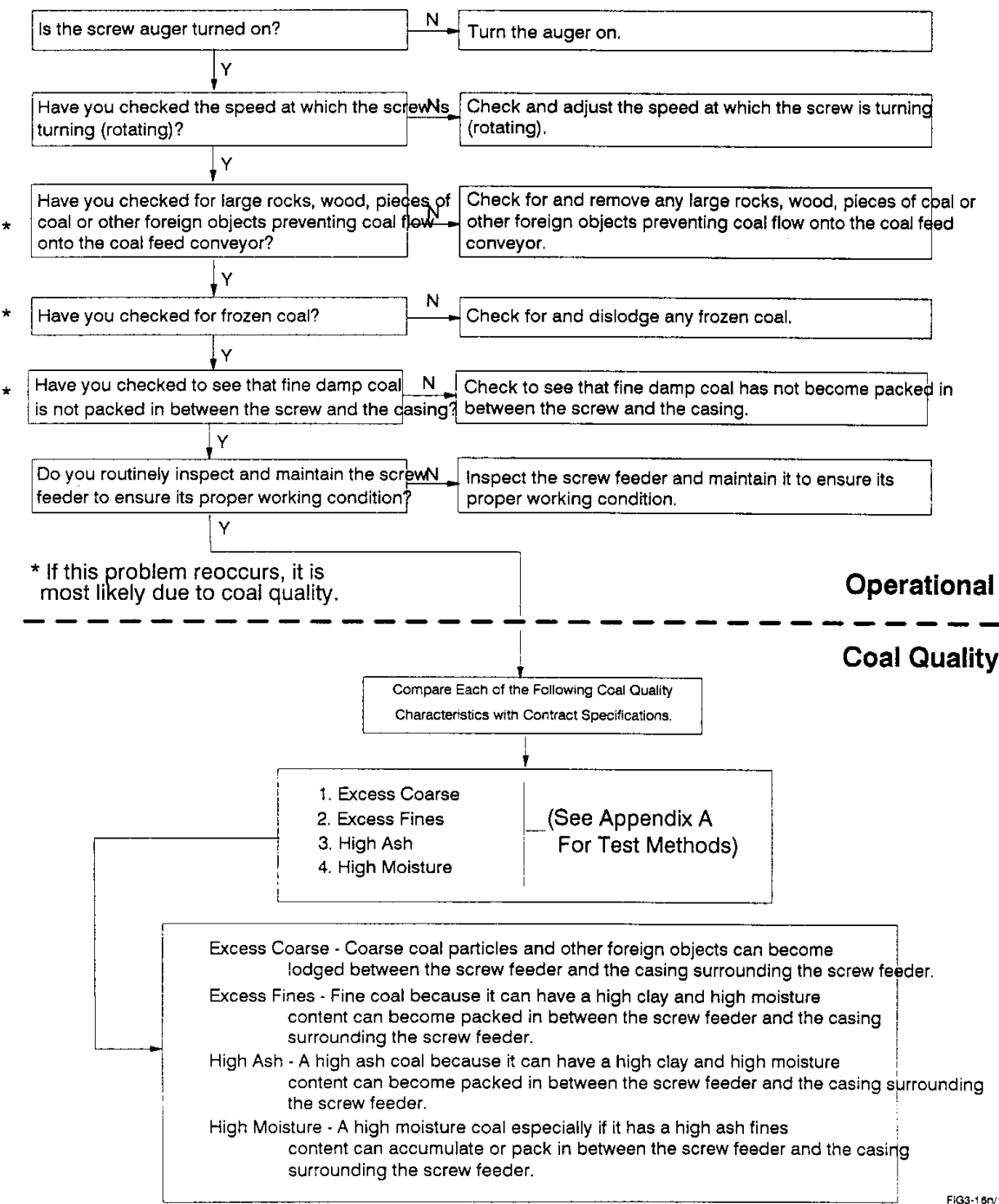


FIG3-16n/1

FIGURE 3-17: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Erratic Feed From The Automatic Coal Reclaim  
(Screw Feeder)

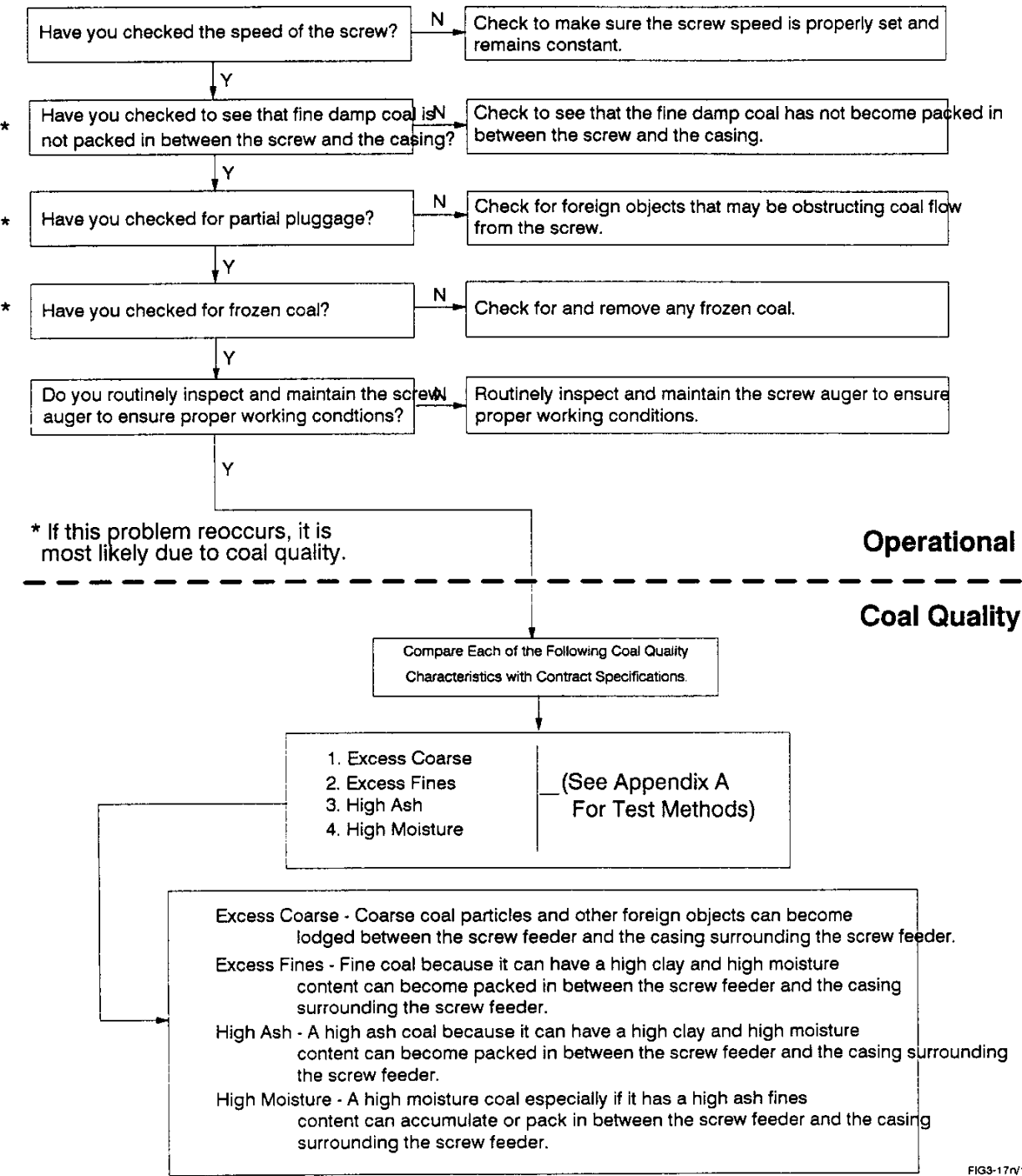


FIG3-17n/1

FIGURE 3-18: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Excess Wear Of The Automatic Coal Reclaim  
(Reciprocating Feeder)

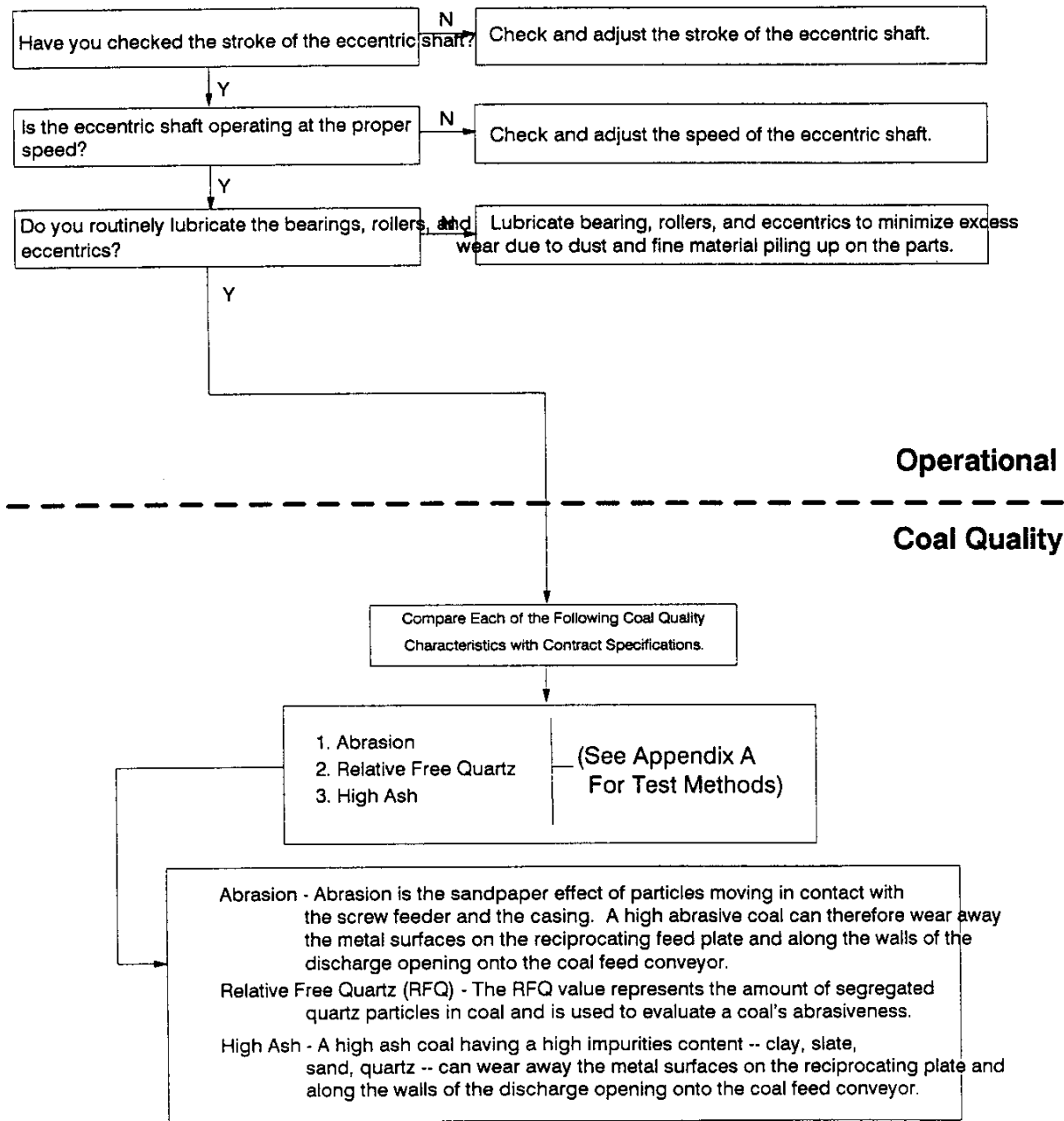


FIG3-18v1

**FIGURE 3-19: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM**  
**For Pluggage In The Automatic Coal Reclaim**  
**(Reciprocating Feeder)**

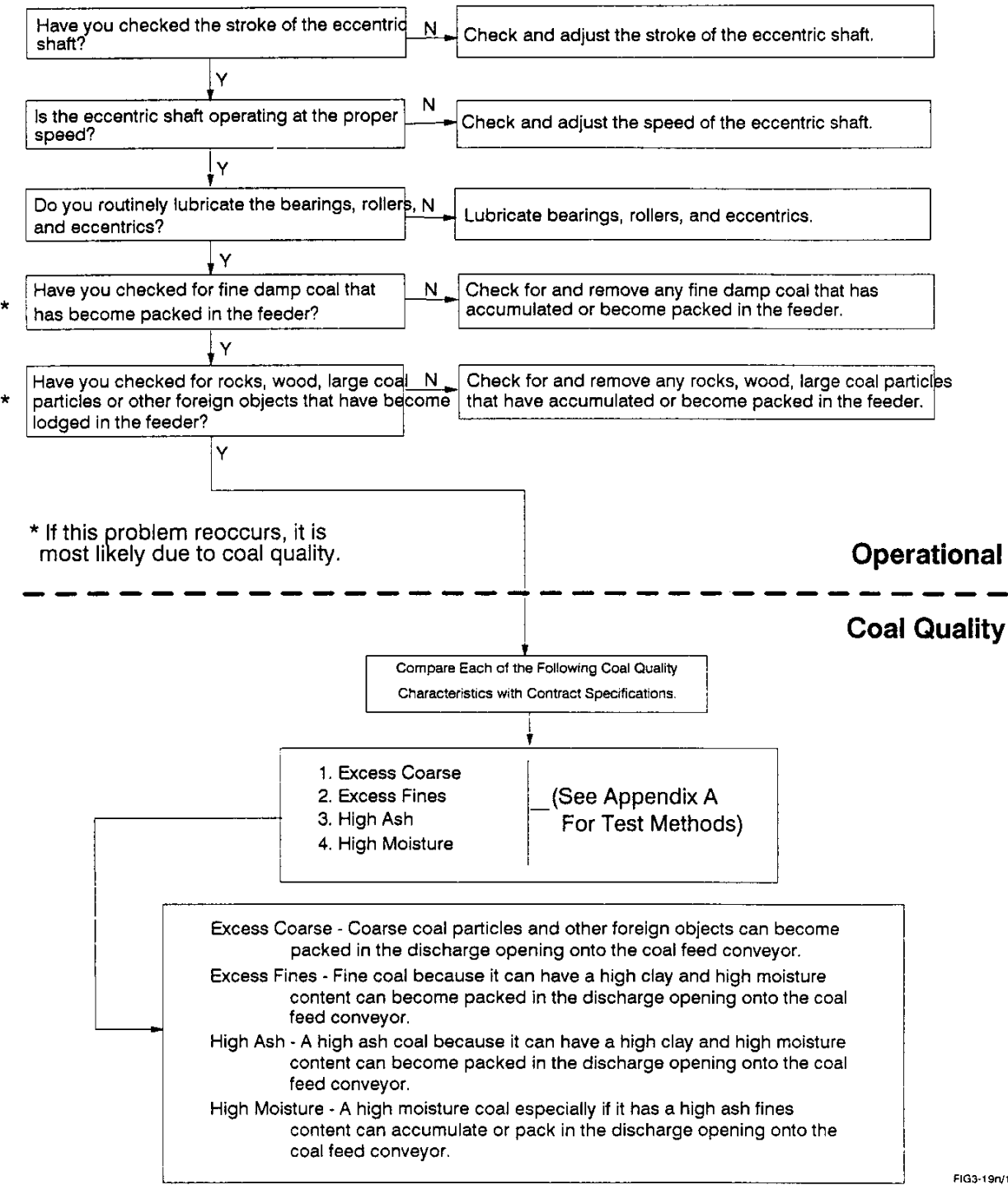


FIG3-19n/1

**FIGURE 3-20: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM**  
**For Insufficient Capacity Of The Automatic Coal Reclaim**  
**(Reciprocating Feeder)**

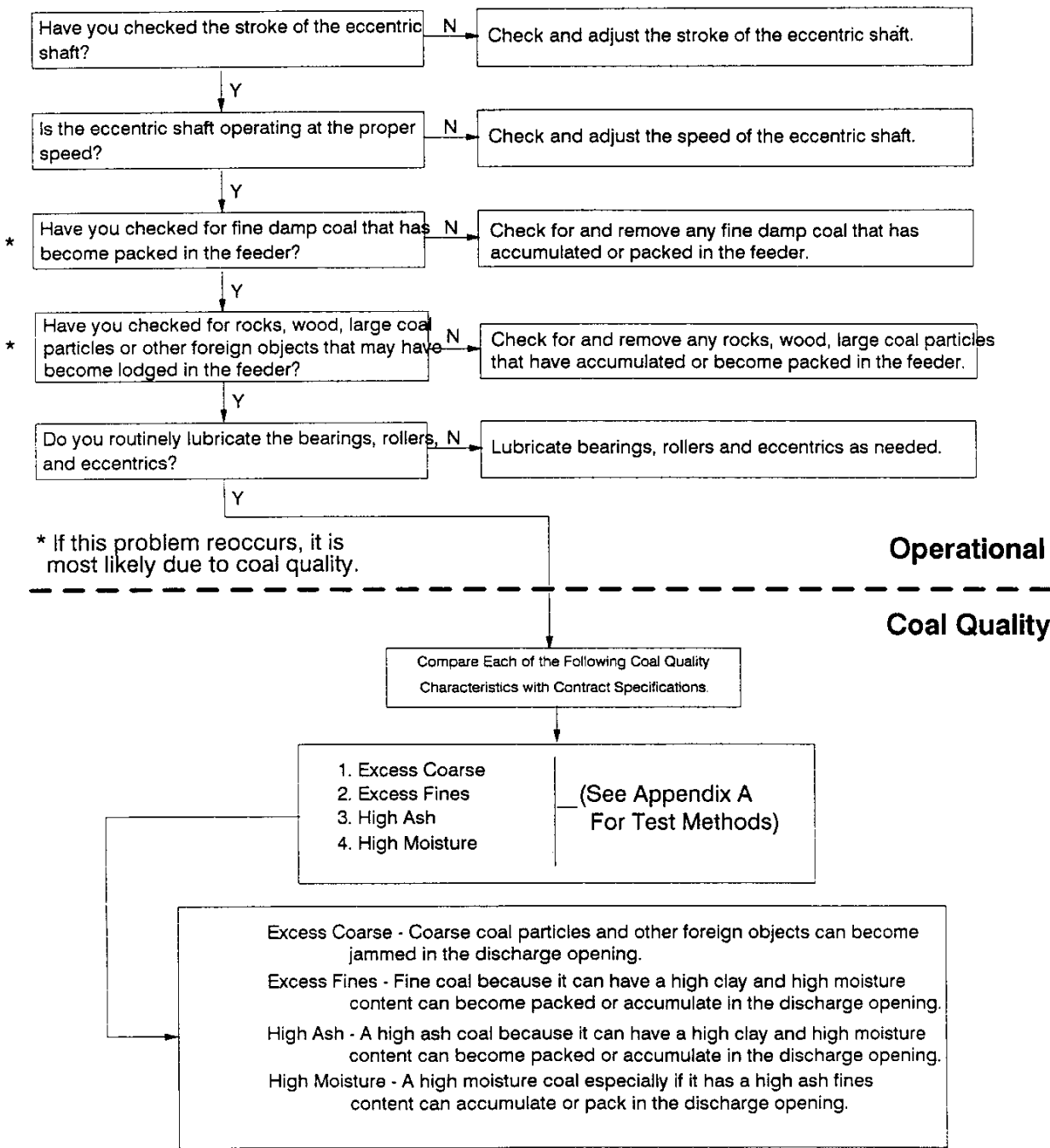


FIG3-20v1

**FIGURE 3-21: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM**  
**For Erratic Feeding From The Automatic Coal Reclaim**  
**(Reciprocating Feeder)**

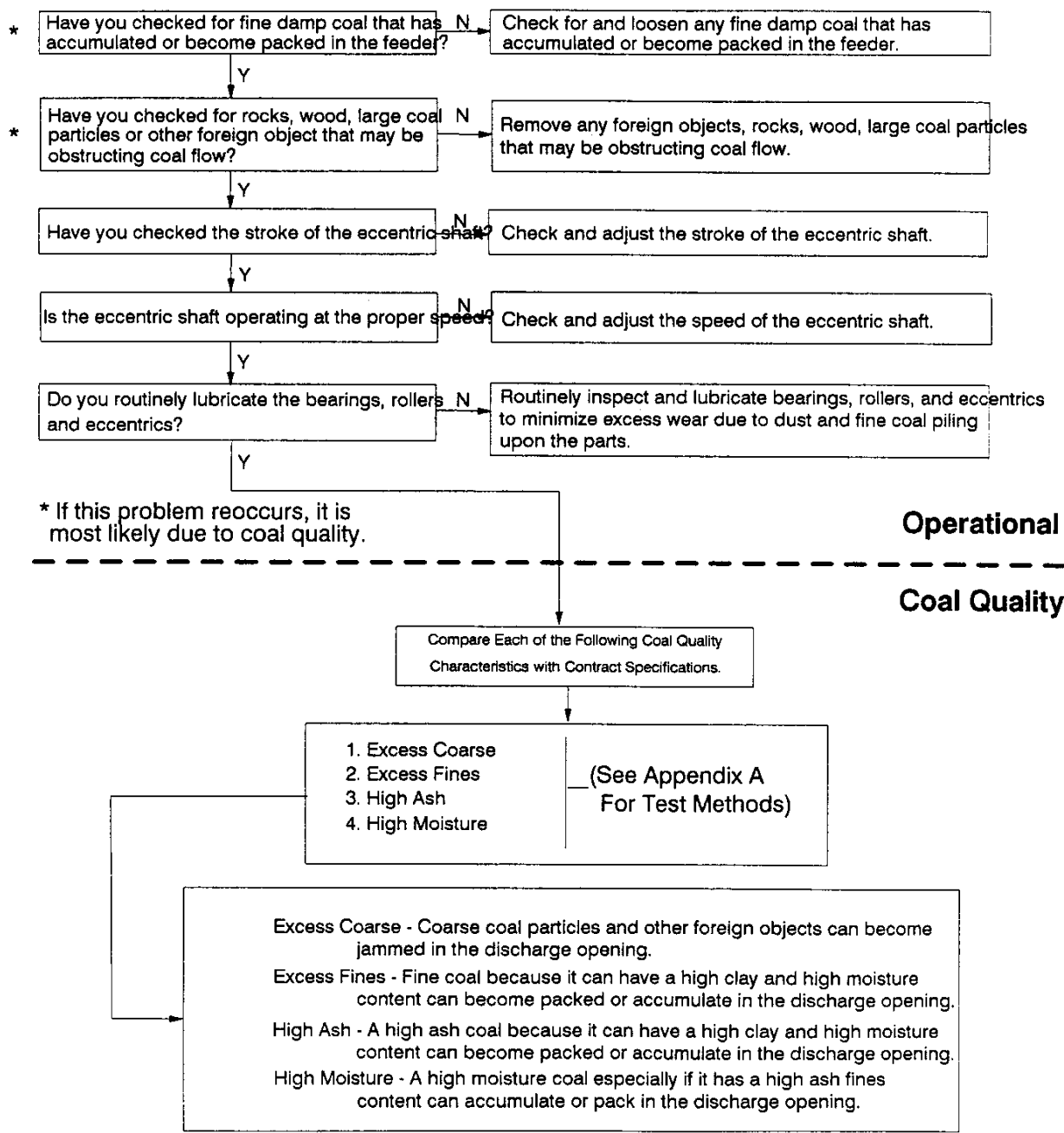




FIGURE 3-22: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Excess Wear Of The Coal Feed Conveyor  
(Belt Conveyor)

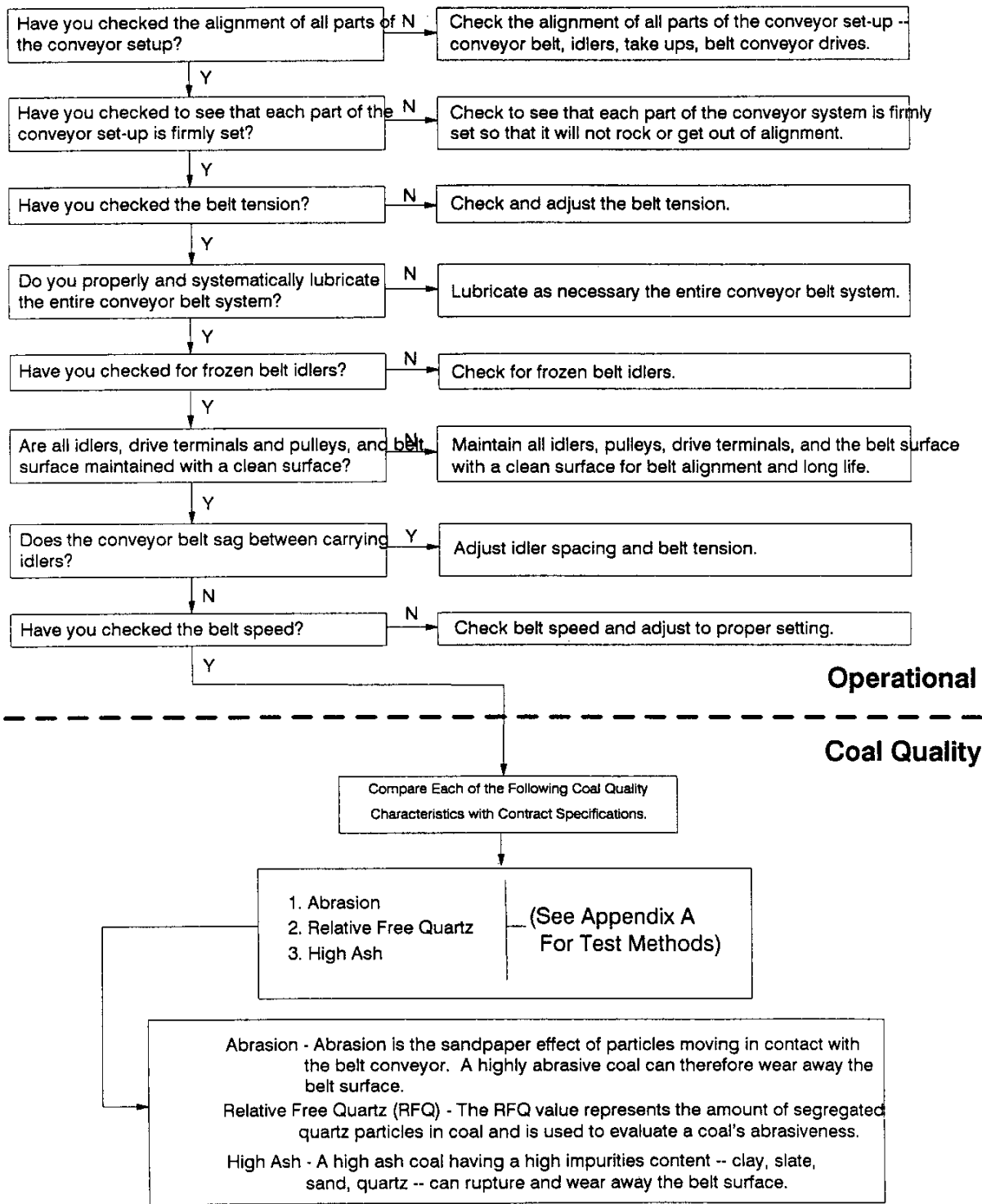


FIG3-22n/1

FIGURE 3-23: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Pluggage In The Coal Feed Conveyor  
(Belt Conveyor)

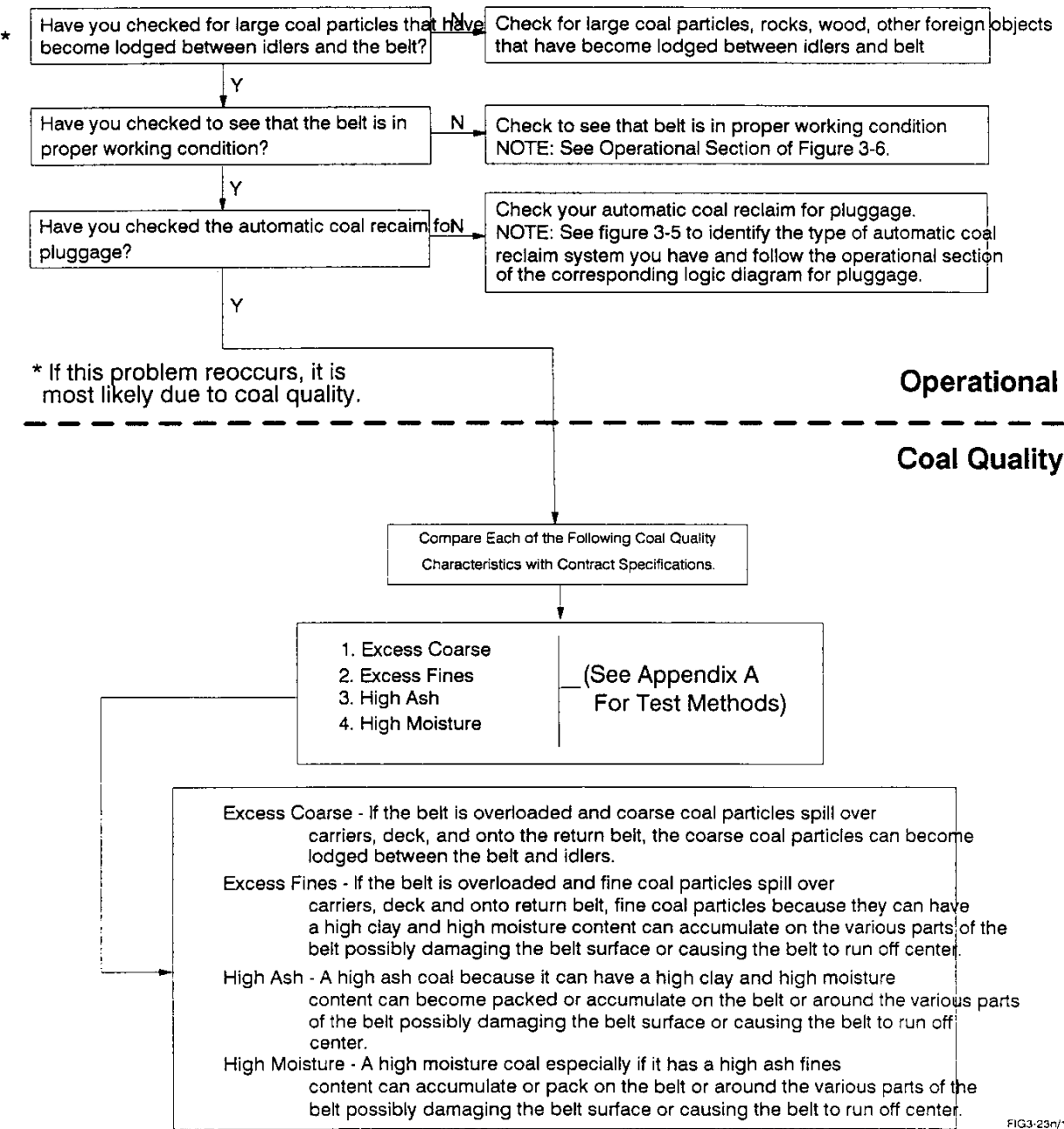


FIGURE 3-24: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Insufficient Capacity Of The Coal Feed Conveyor  
(Belt Conveyor)

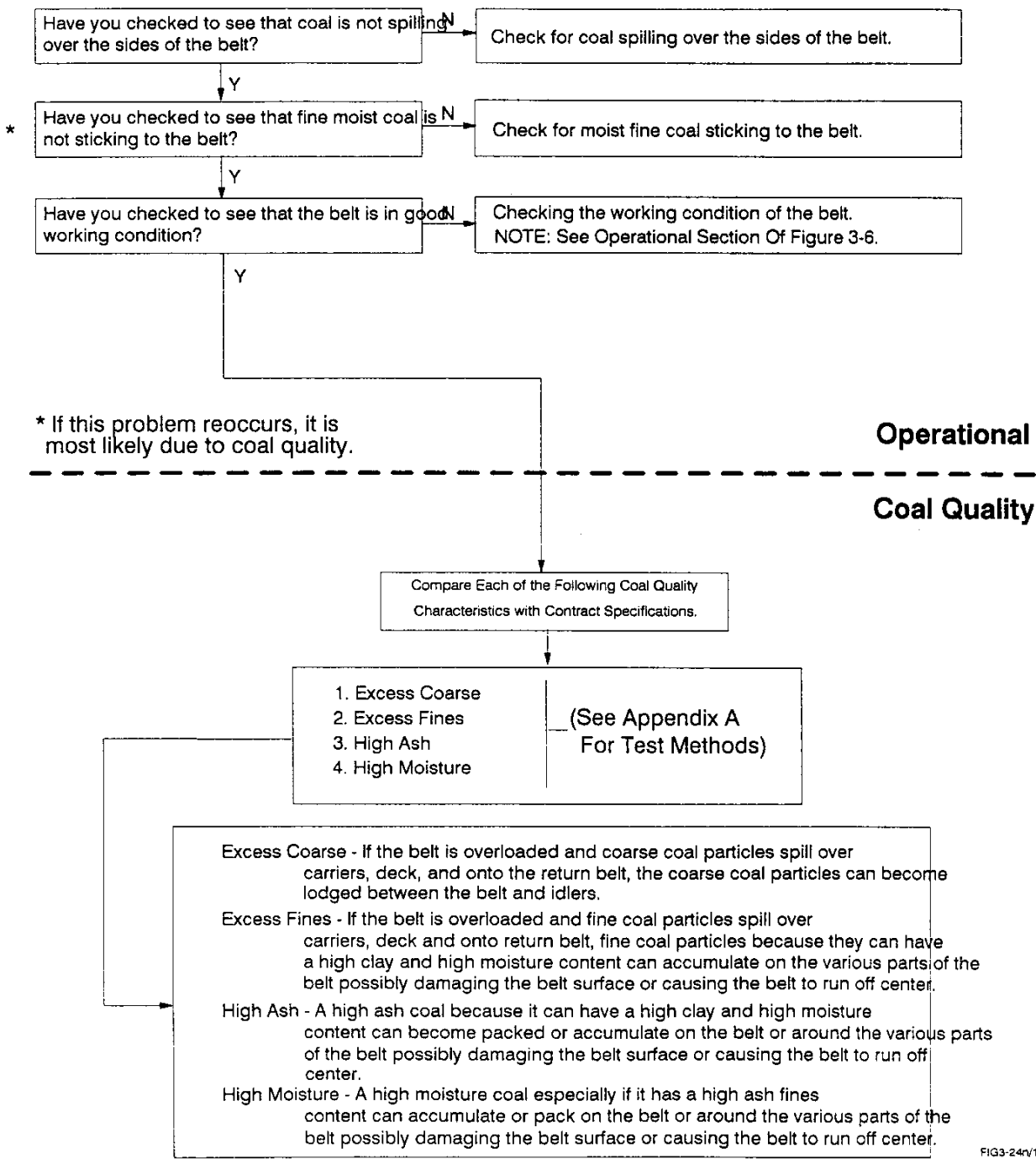


FIG3-24v1

FIGURE 3-25: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Erratic Feeding From The Coal Feed Conveyor  
(Belt Conveyor)

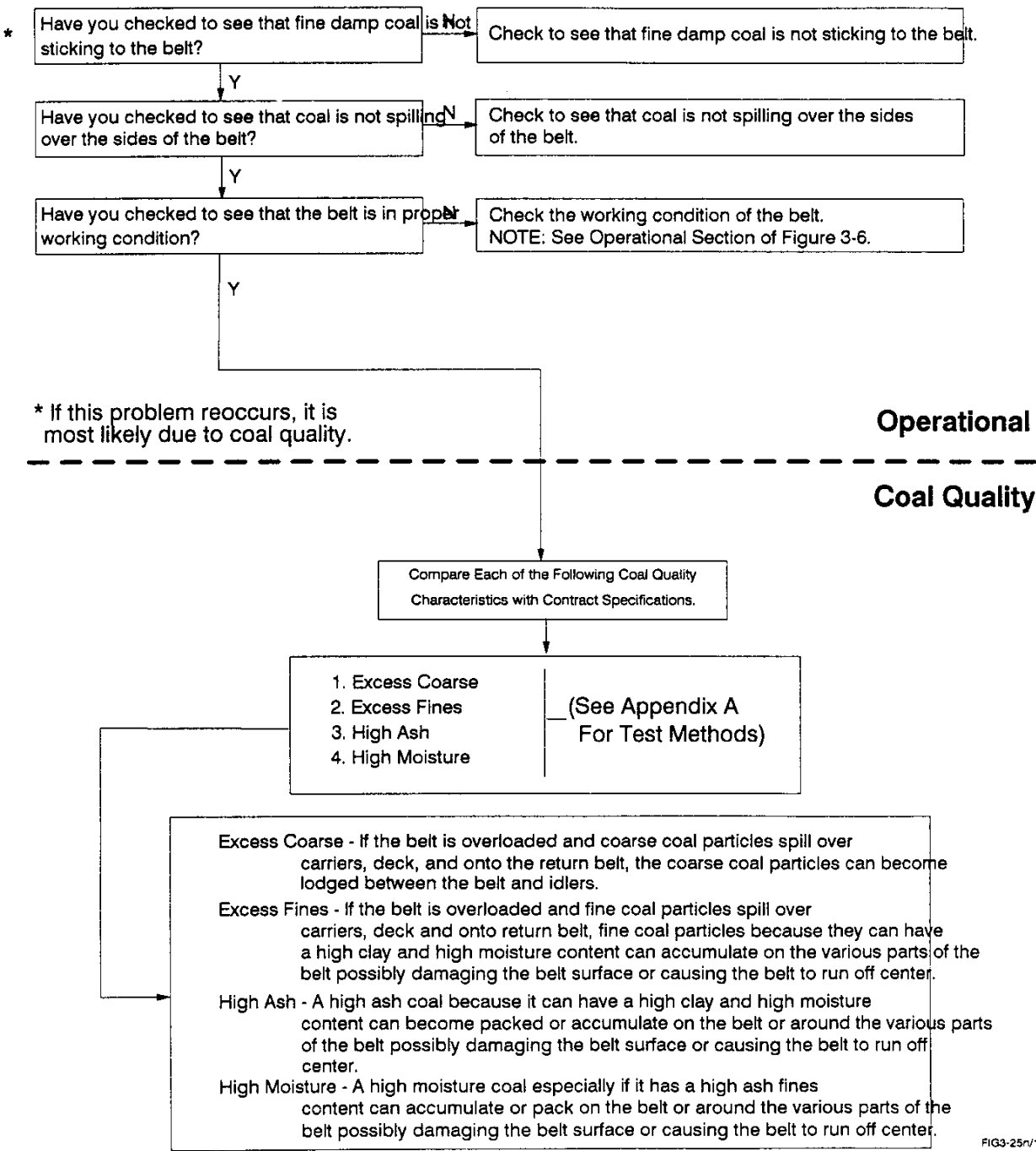


FIG3-25/n/1

**FIGURE 3-26: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM**  
**for Excess Wear In The Coal Feed Conveyor**  
**(Screw Conveyor)**

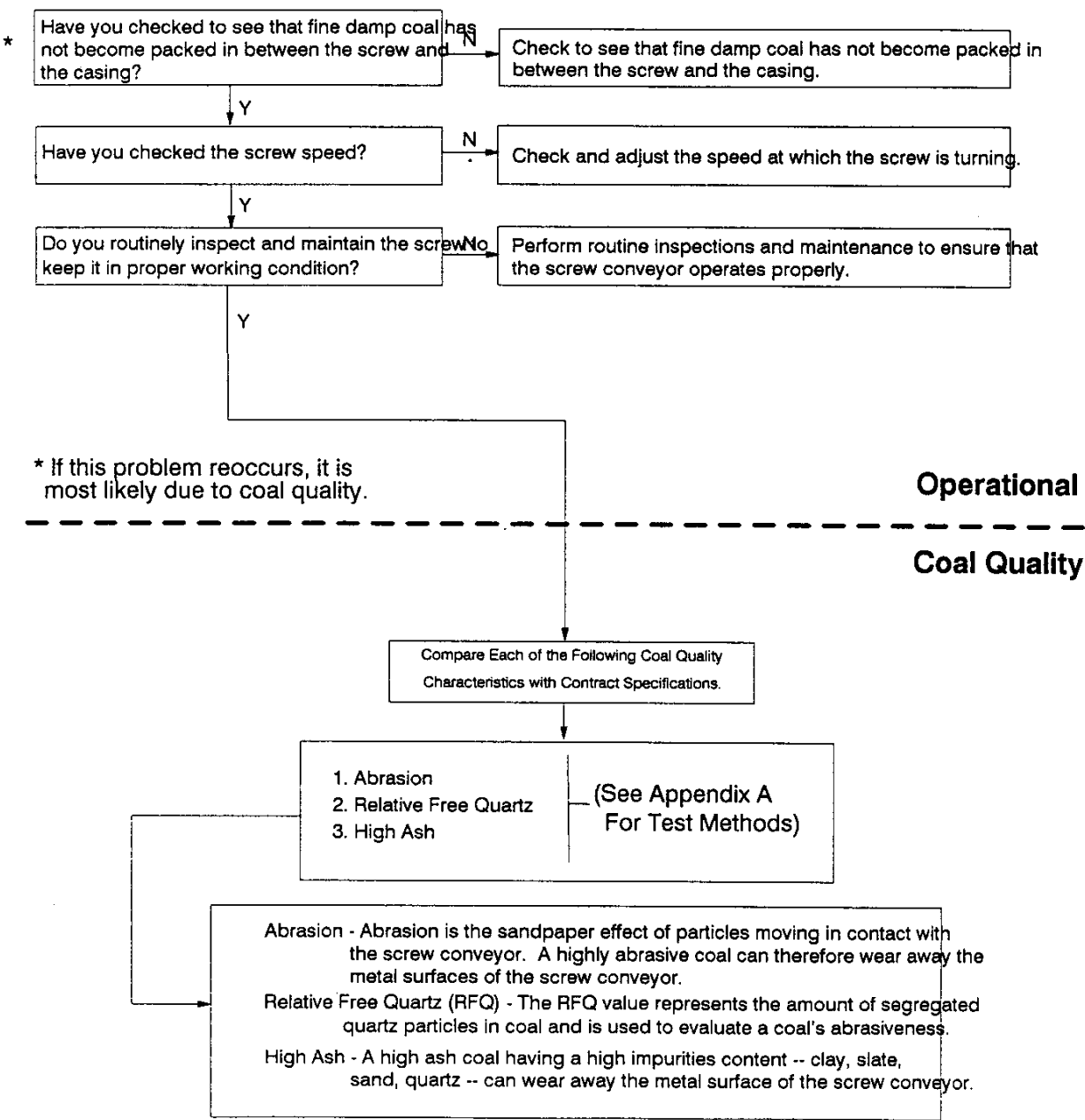


FIG3-26v1

**FIGURE 3-27: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM**  
**For Pluggage In The Coal Feed Conveyor**  
**(Screw Conveyor)**

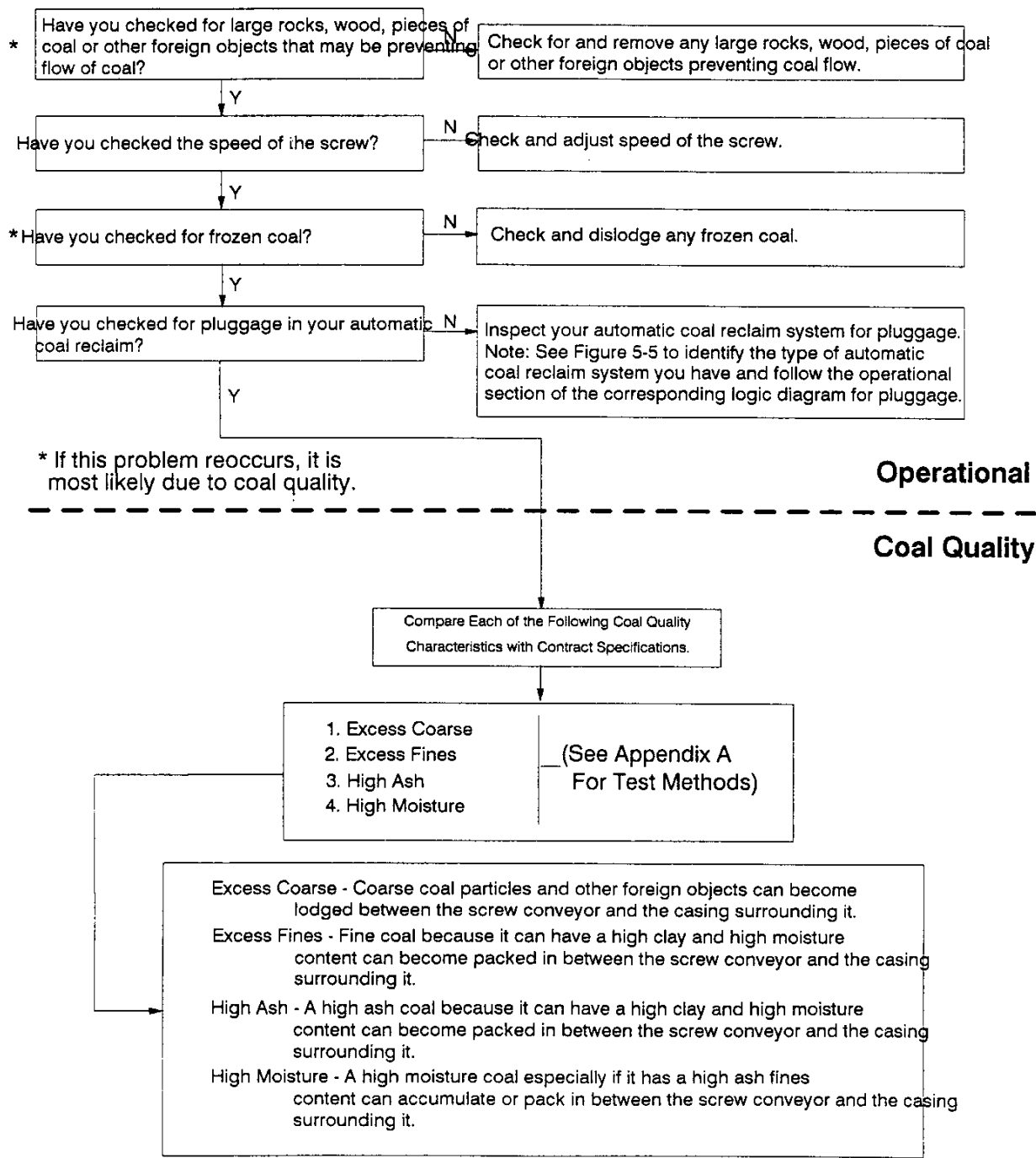


FIGURE 3-28: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Insufficient Capacity Of The Coal Feed Conveyor  
(Screw Conveyor)

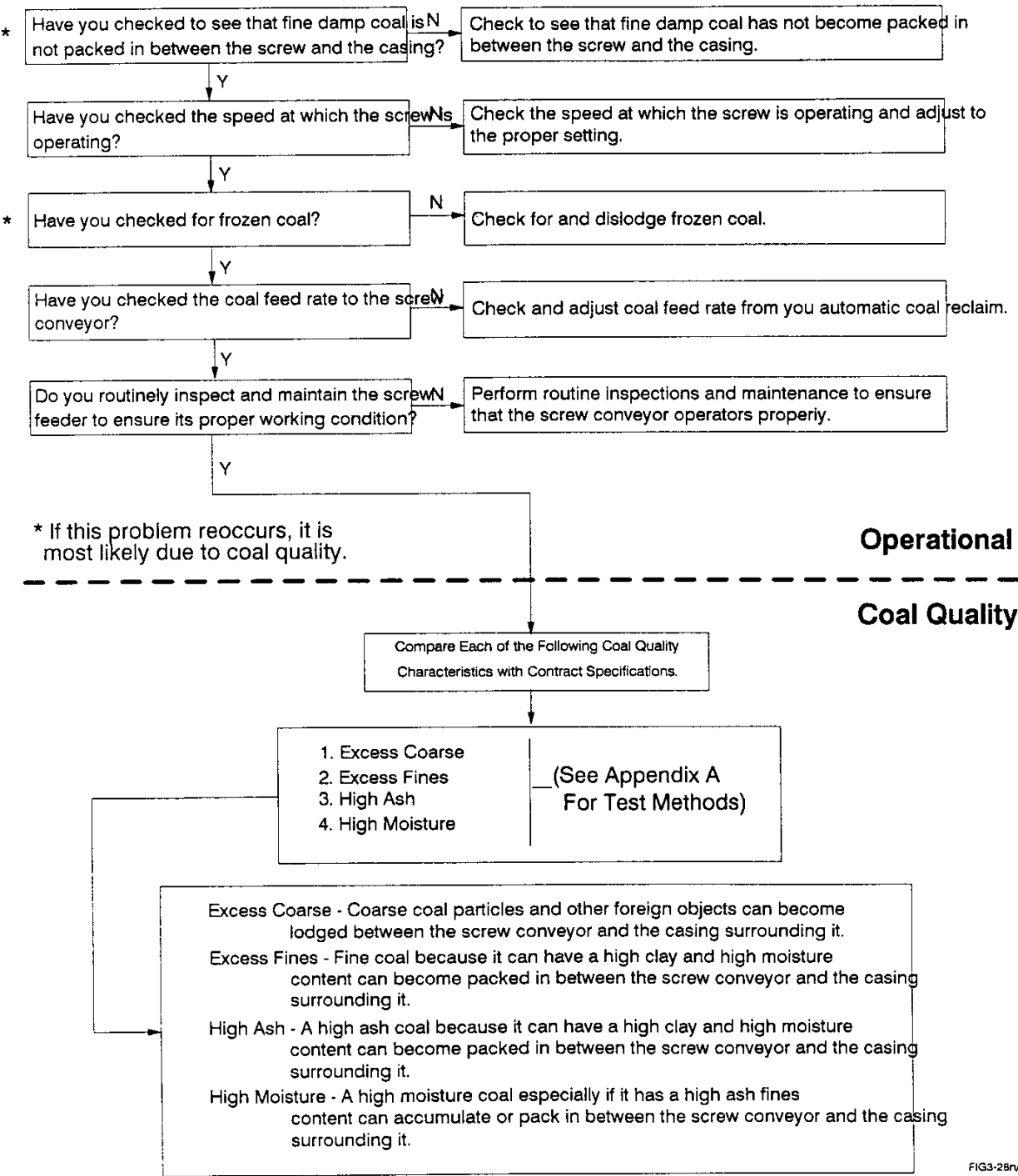


FIG3-28r/1

**FIGURE 3-29: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM**  
**For Erratic Feeding From The Coal Feed Conveyor**  
**(Screw Conveyor)**

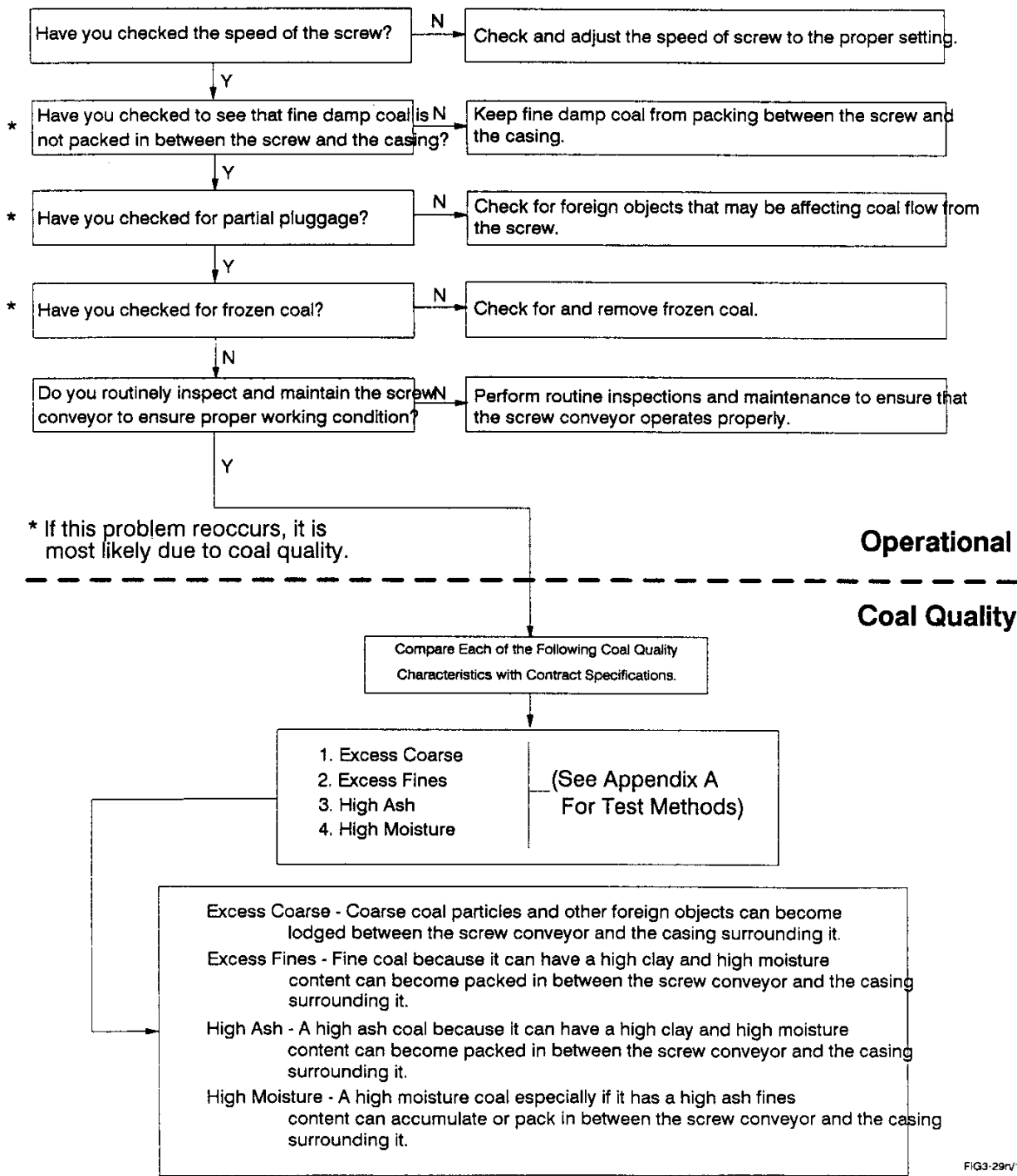




FIGURE 3-30: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Excess Wear In The Coal Feed Conveyor  
(Bucket Conveyor)

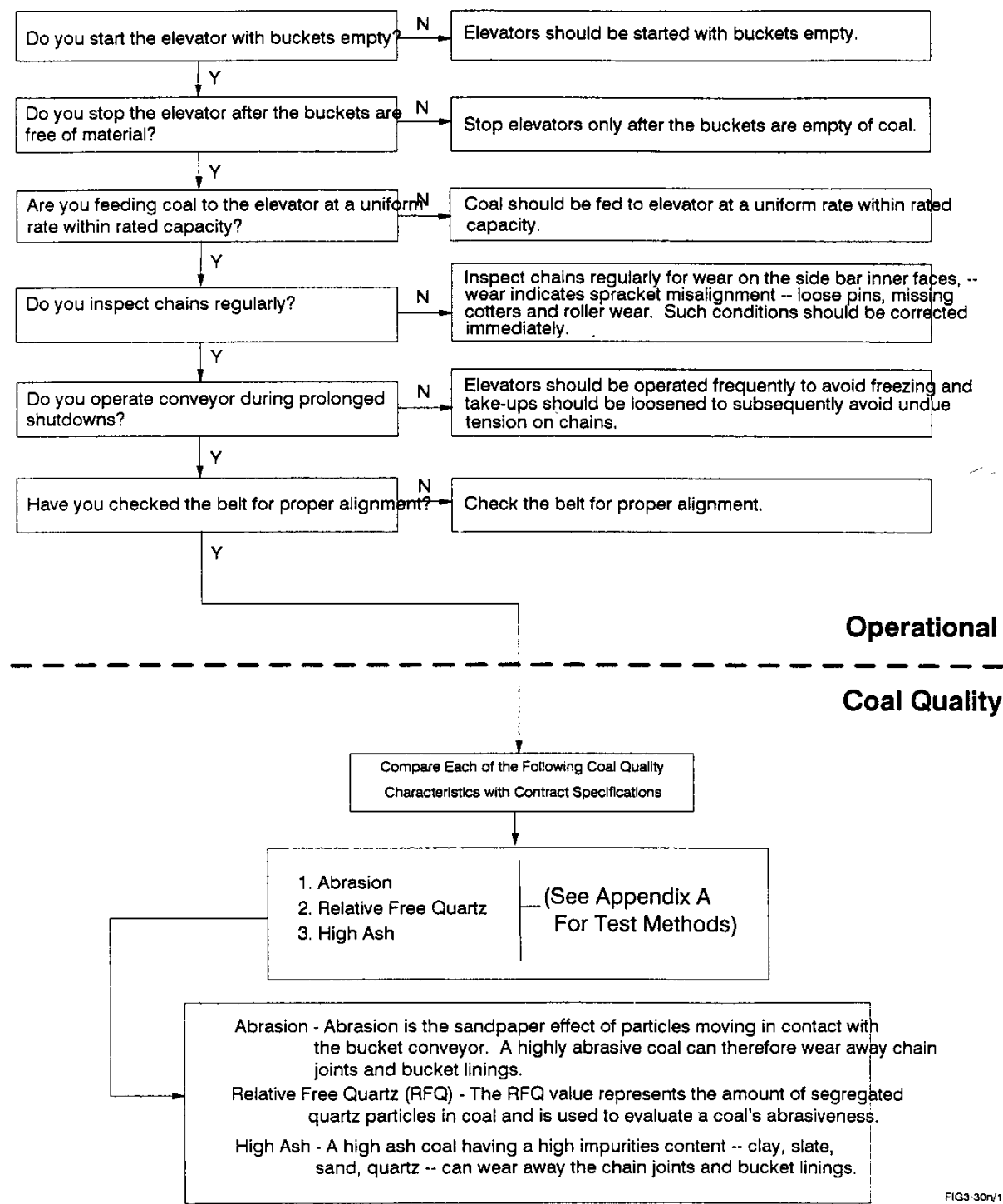


FIG3-30r/1

FIGURE 3-31: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Pluggage In The Coal Feed Conveyor  
(Bucket Conveyor)

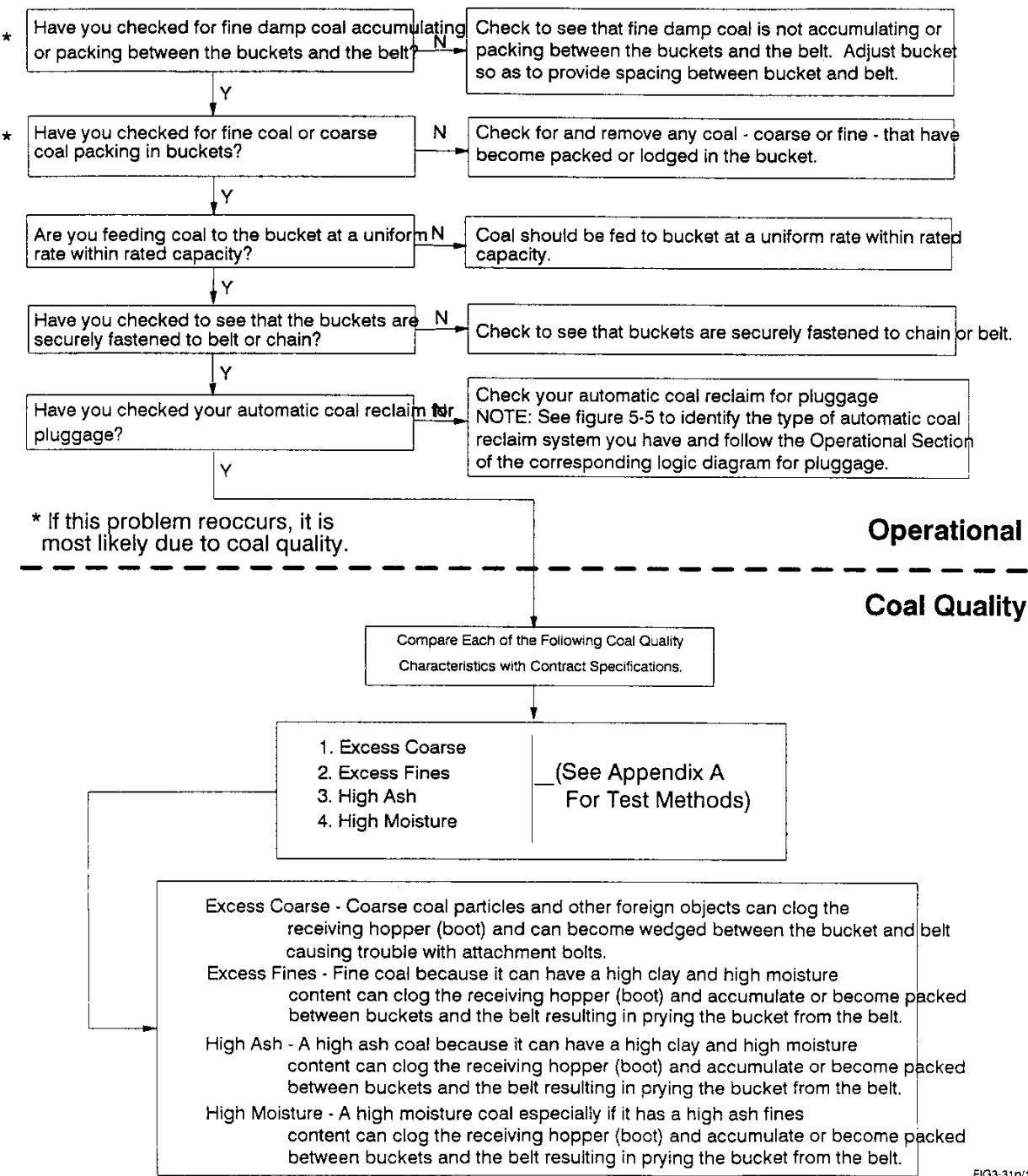


FIG3-31/n/1

**FIGURE 3-32: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM**  
**For Insufficient Capacity Of The Coal Feed Conveyor**  
**(Bucket Conveyor)**

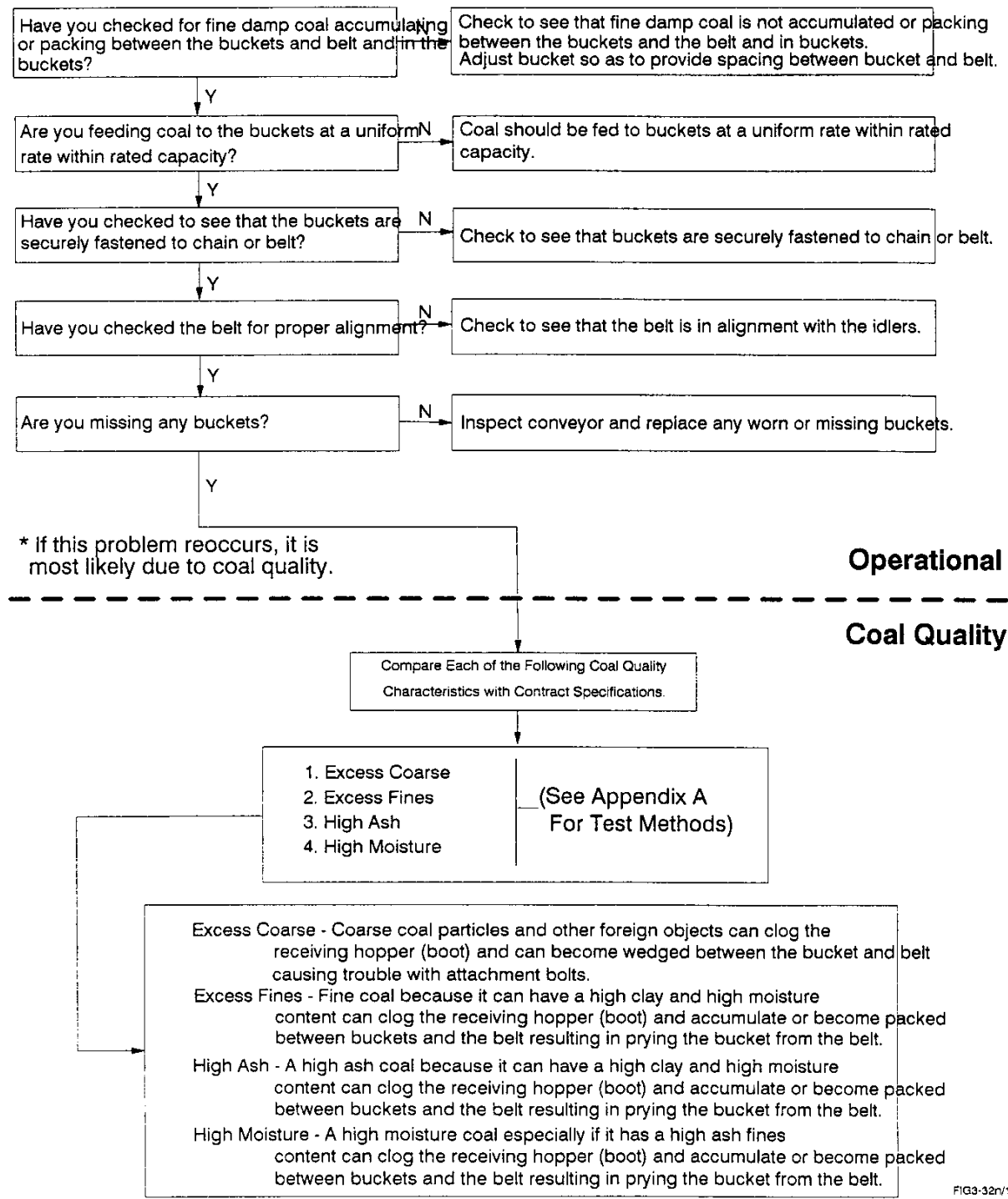


FIGURE 3-33: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
Erratic Feeding From The Coal Feed Conveyor  
(Bucket Conveyor)

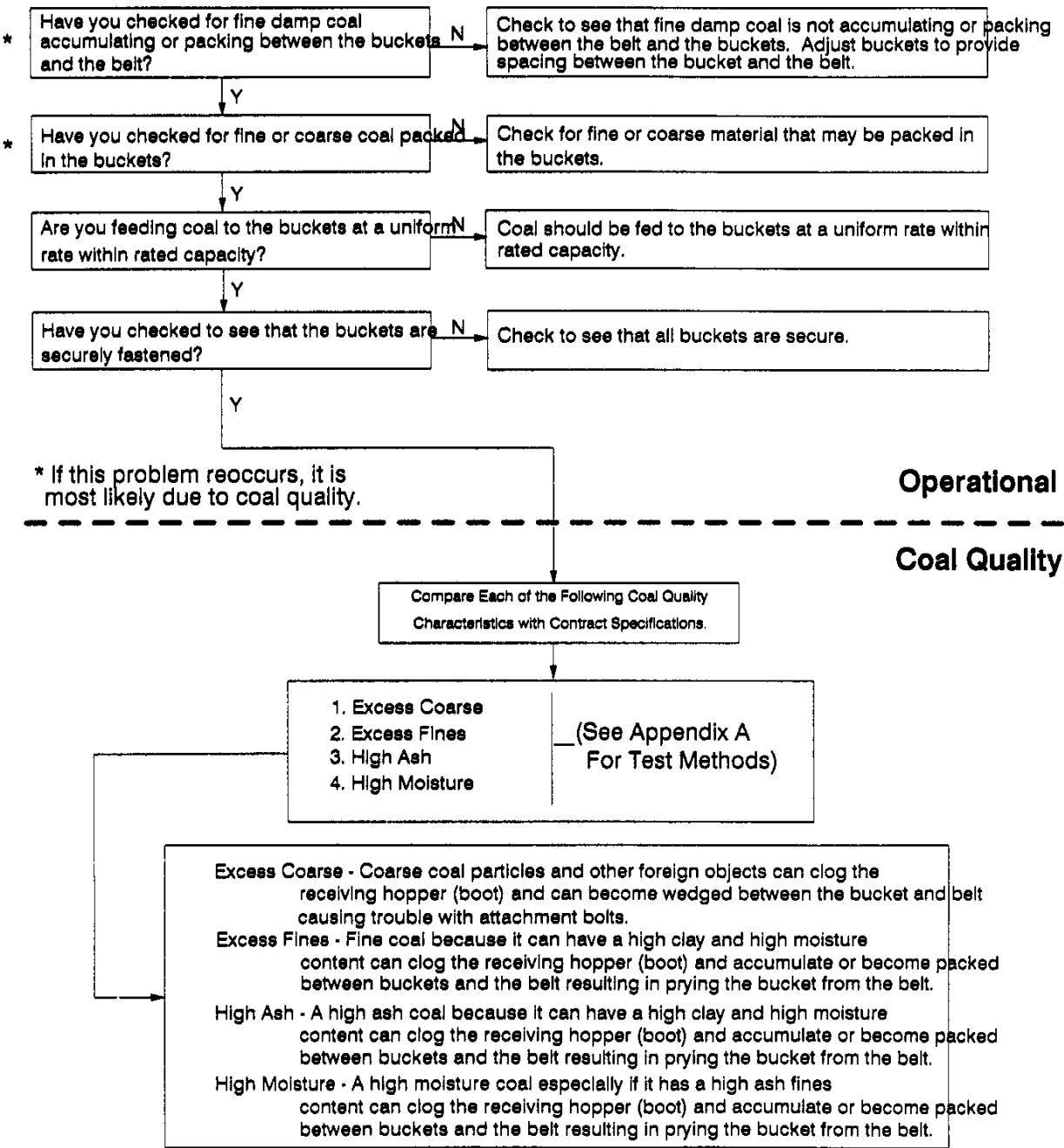
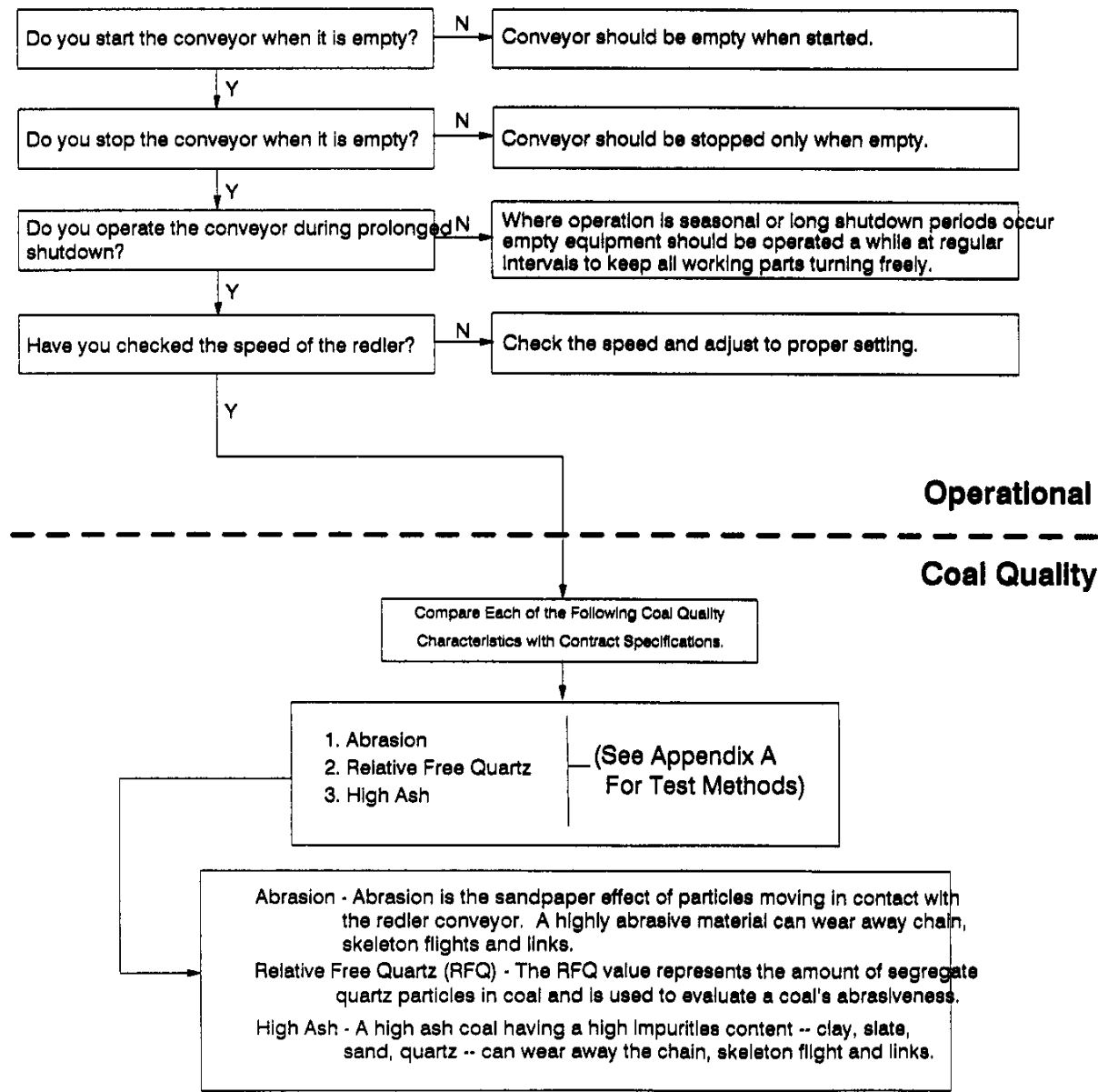


FIG3-33n/1

FIGURE 3-34: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Excess Wear Of Coal Feed Conveyors  
(Redler Conveyors)



**FIGURE 3-35: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM**  
**For Pluggage In The Coal Feed Conveyor**  
**(Redler Conveyor)**

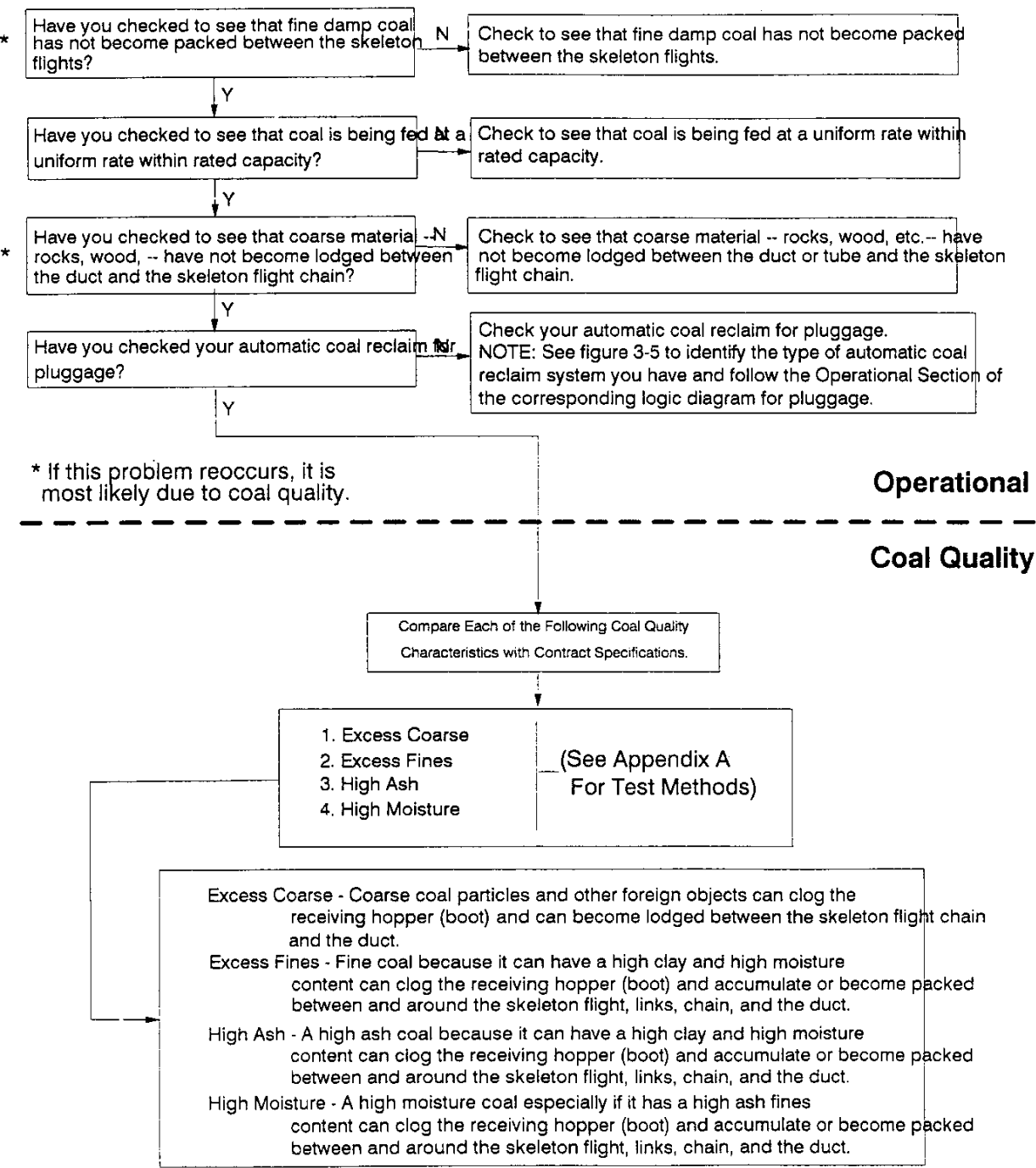


FIG3-35n/1

FIGURE 3-36: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Insufficient Capacity In The Coal Feed Conveyor  
(Redler Conveyor)

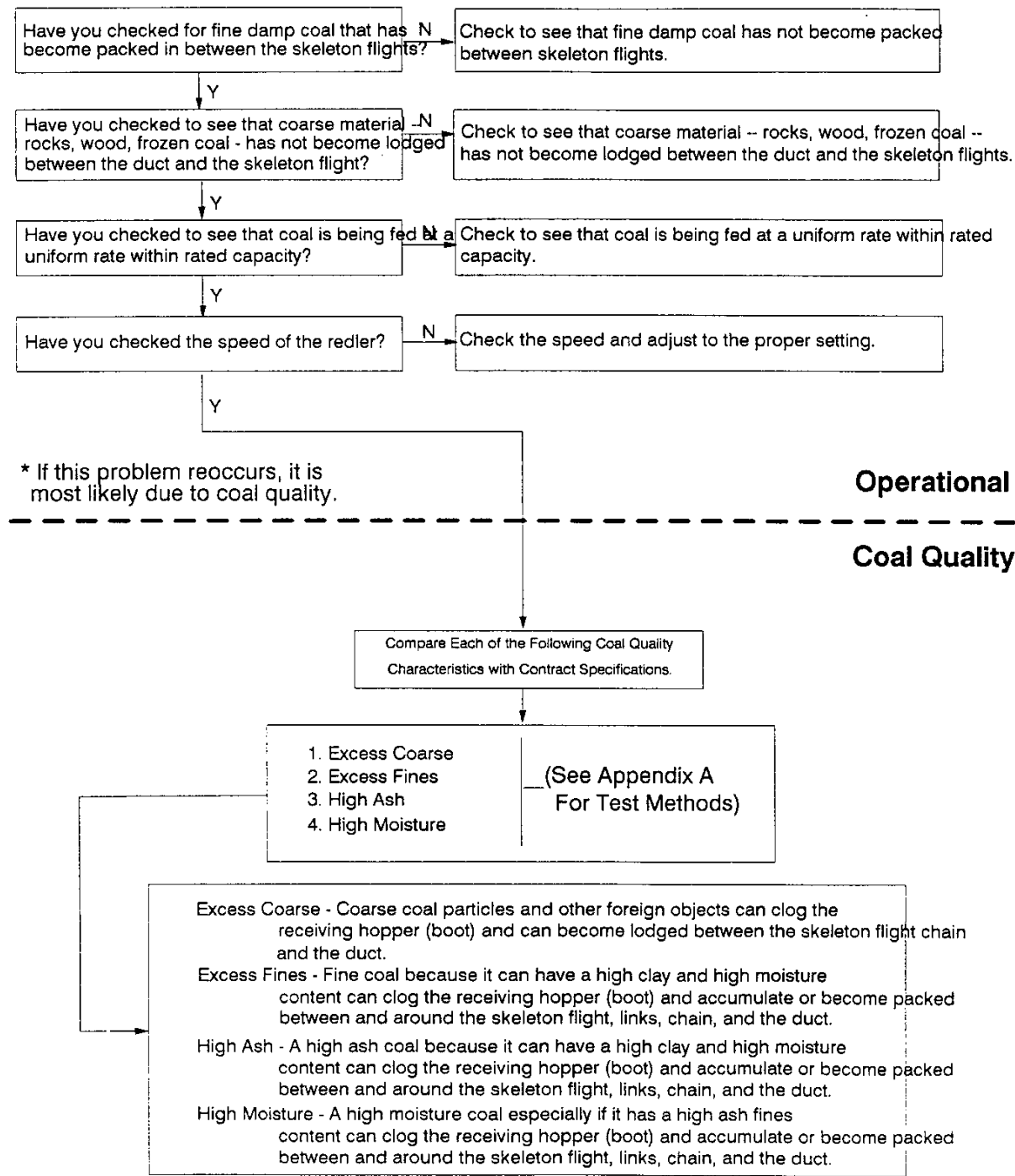
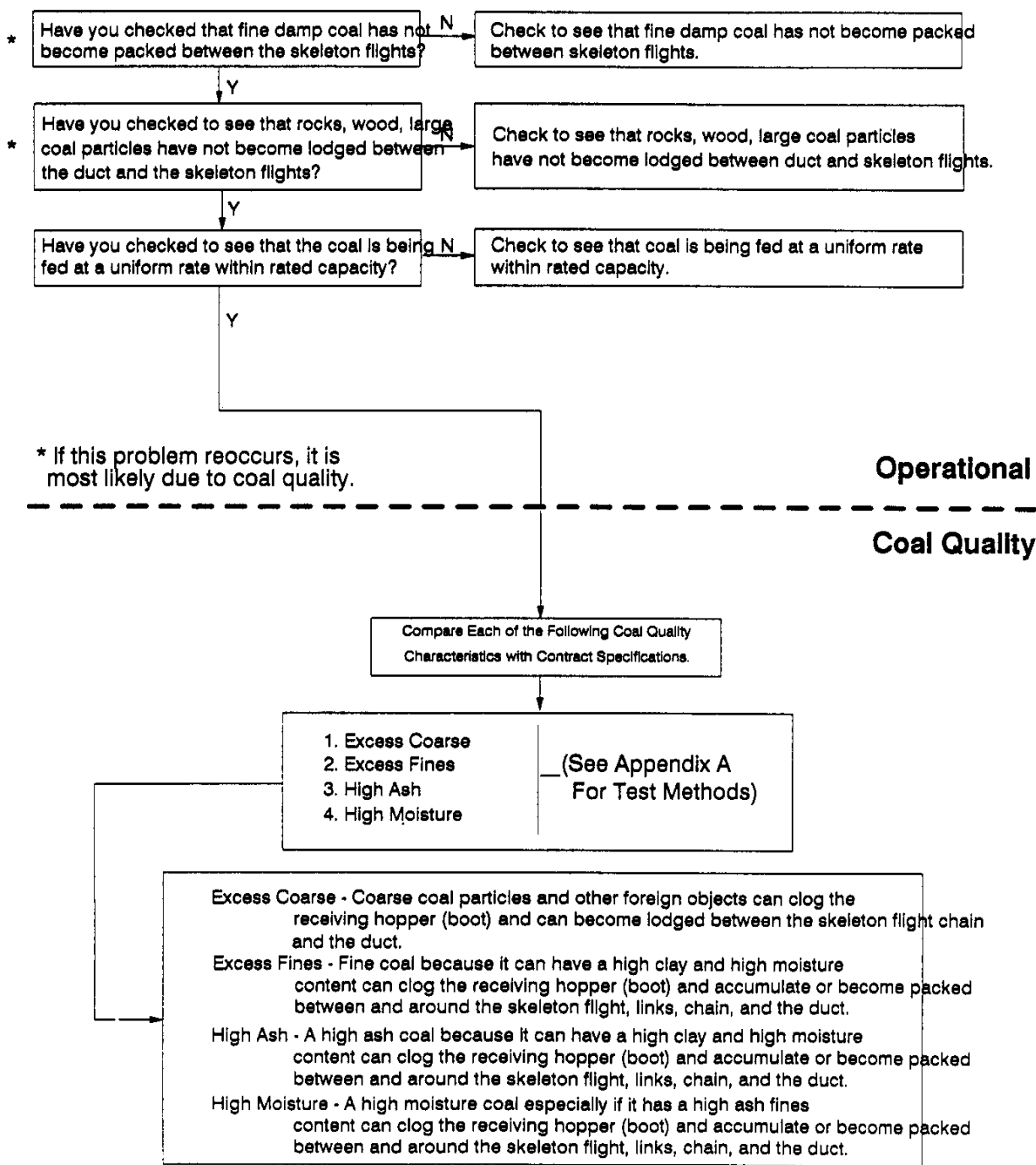
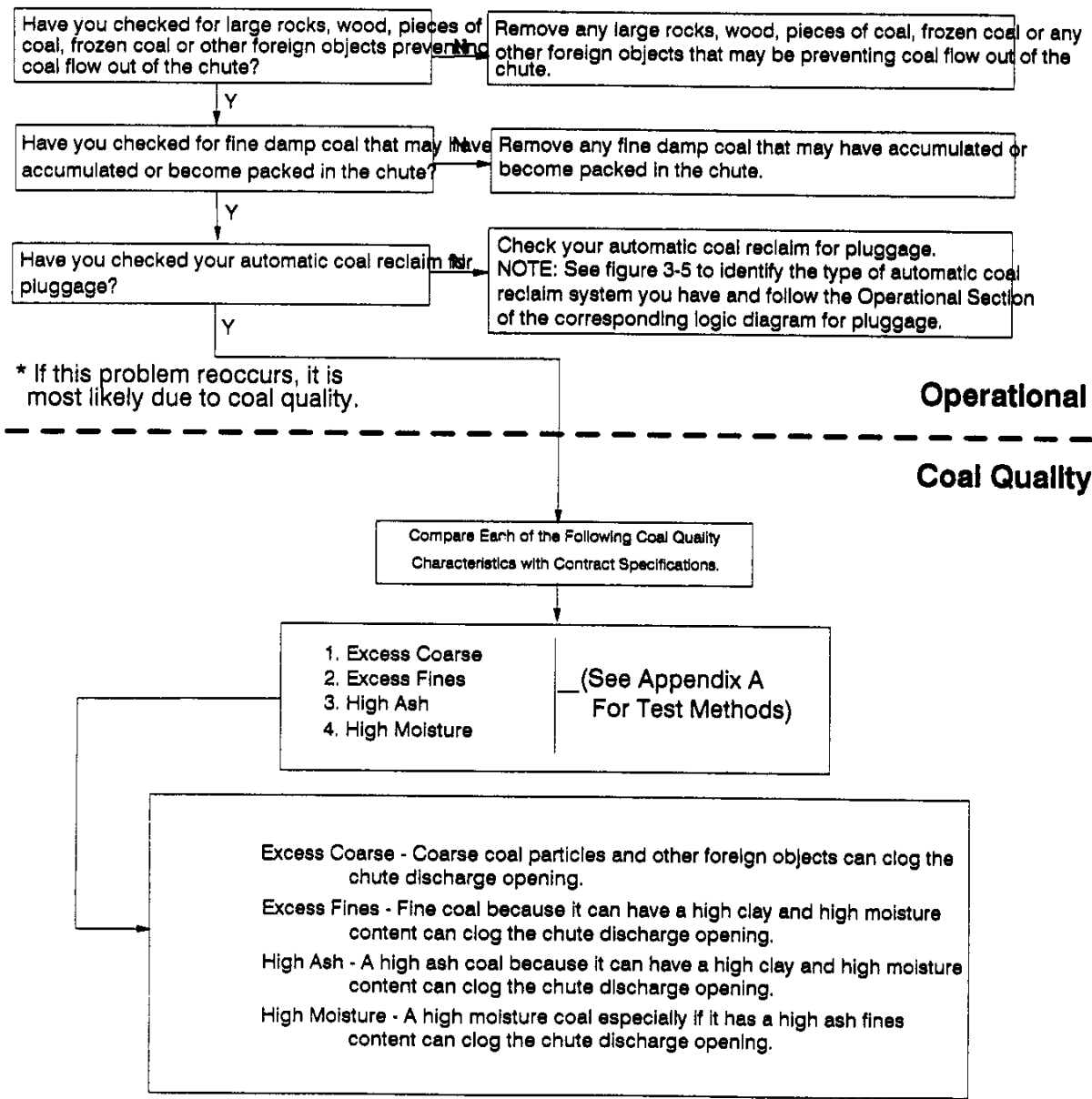


FIGURE 3-37: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Erratic Feeding From The Coal Feed Conveyor  
(Redler Conveyor)





**FIGURE 3-38: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM**  
**For Pluggage In The Coal Feed Conveyor**  
**(Chutes)**



**FIGURE 3-39: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM**  
**For Insufficient Capacity In The Coal Feed Conveyor**  
**(Chutes)**

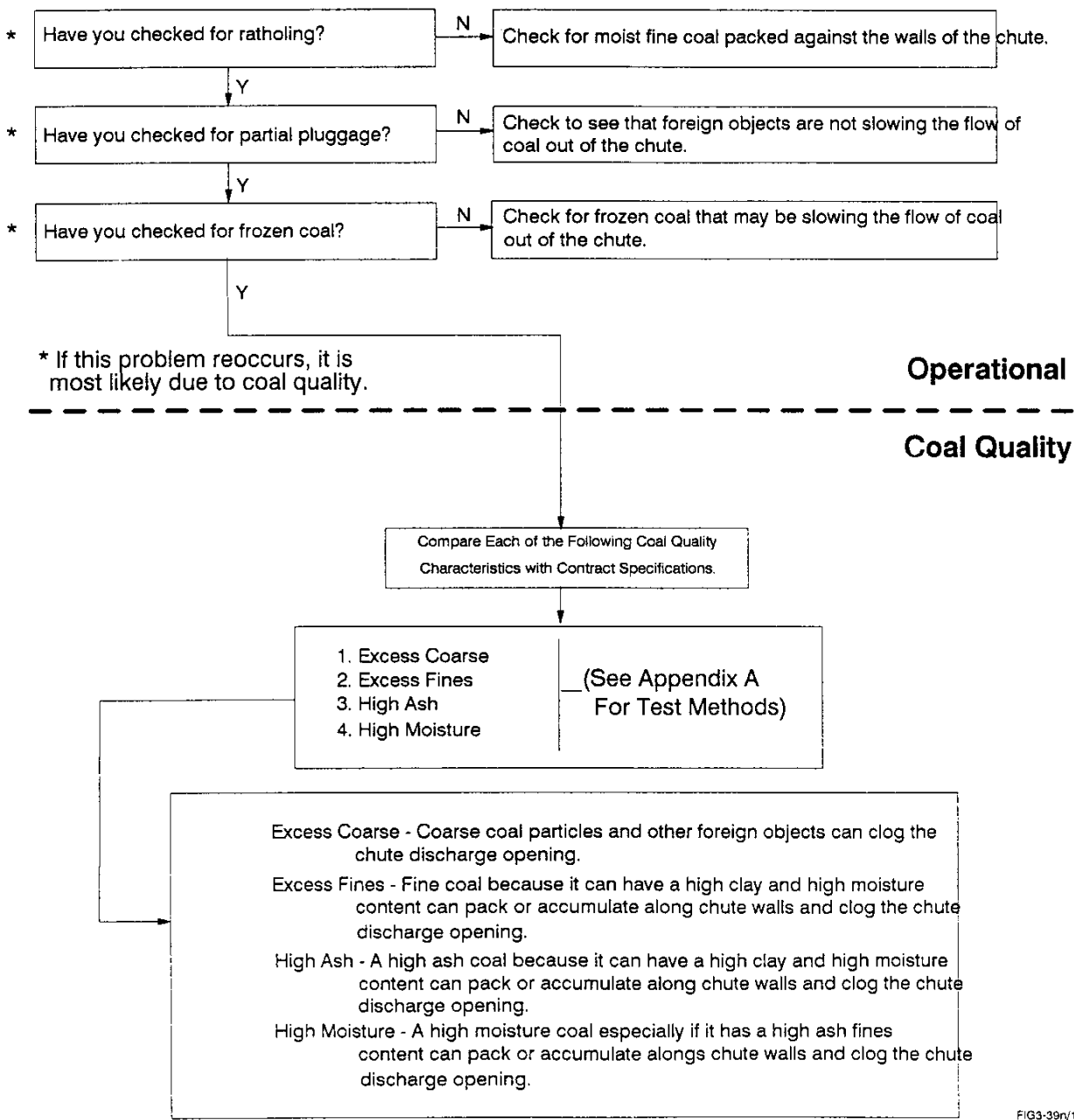


FIG3-39v1

FIGURE 3-40: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Erratic Feeding From The Coal Feed Conveyor  
(Chute)

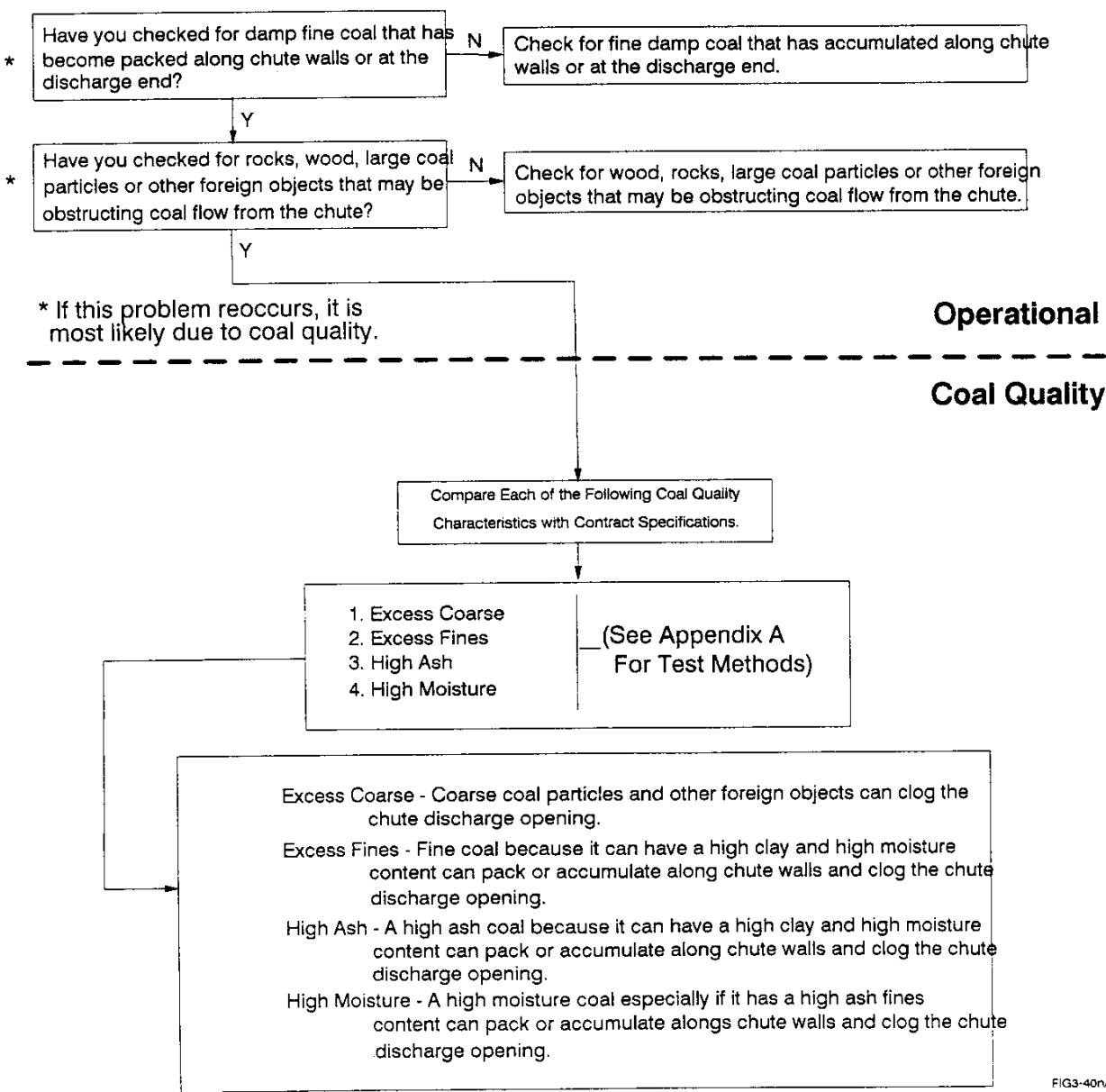


FIG3-40n/1

**FIGURE 3-41: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM**  
**For Pluggage In The Coal Feeders**  
**(Chute)**

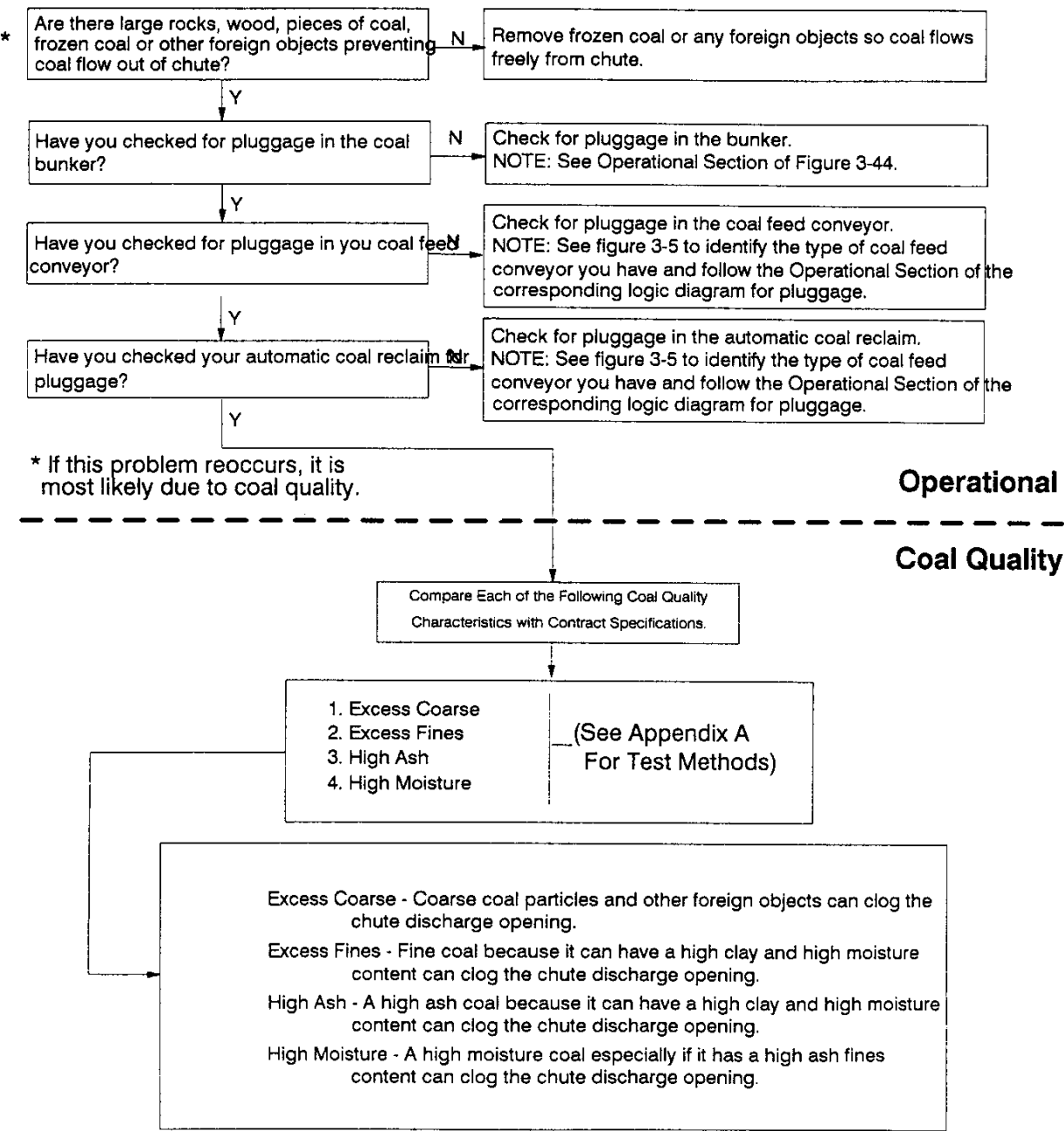
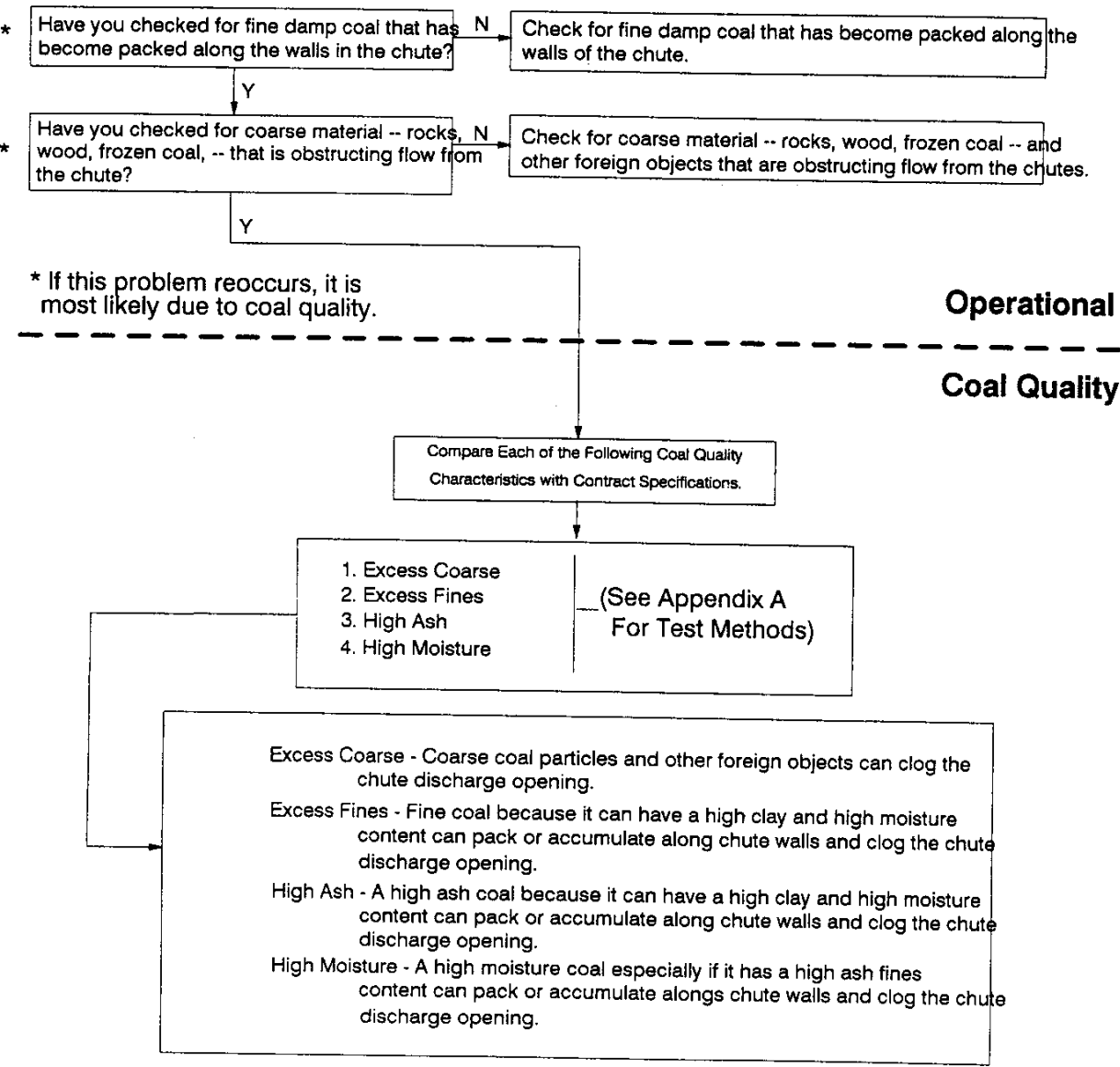


FIG3-41r/1

FIGURE 3-42: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Insufficient Capacity In the Coal Feeder  
(Chutes)



**FIGURE 3-43: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM**  
**For Erratic Feeding From The Coal Feeder**  
**(Chutes)**

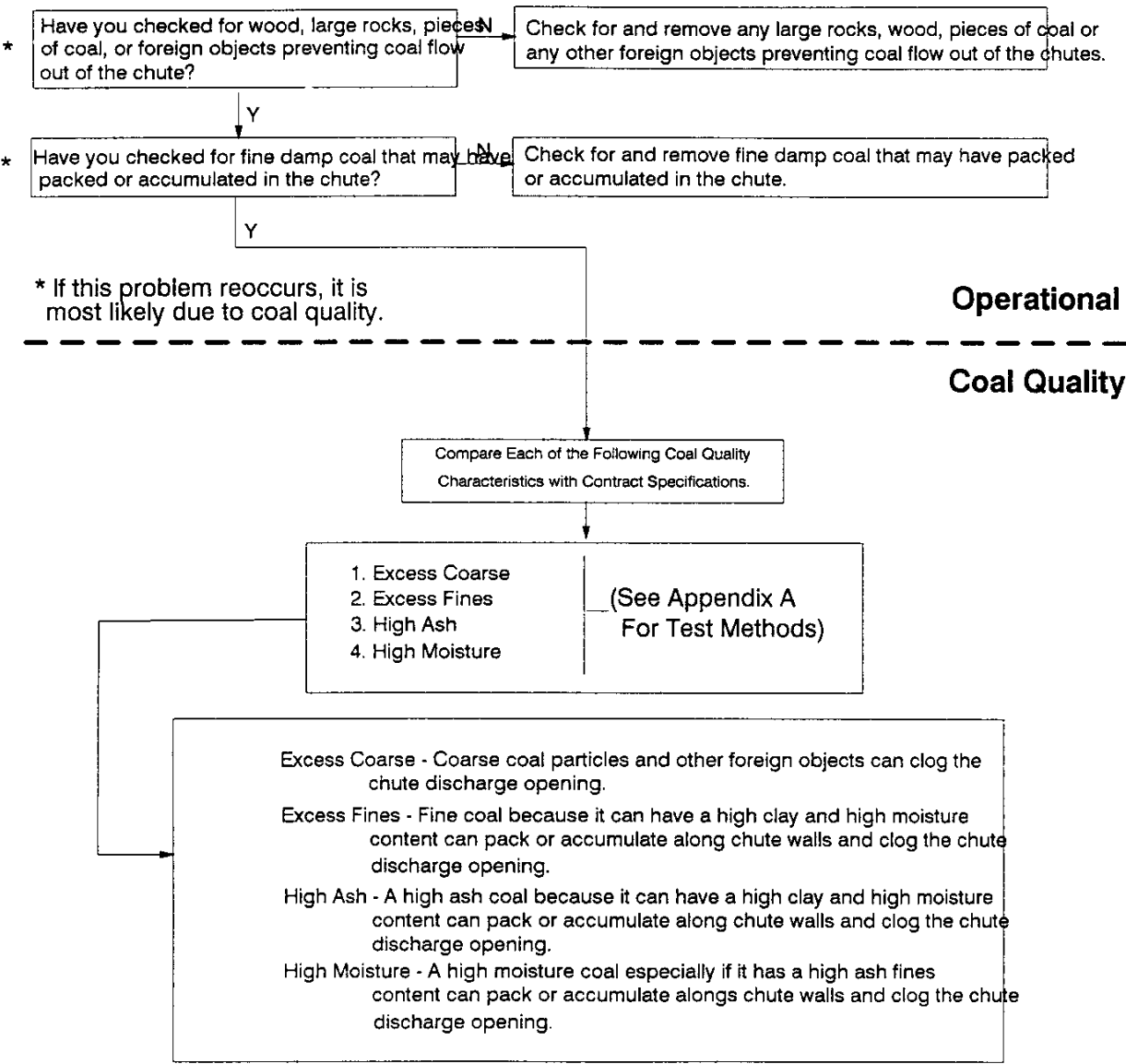


FIG3-43n/2

FIGURE 3-44: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Pluggage In The Coal Bunker

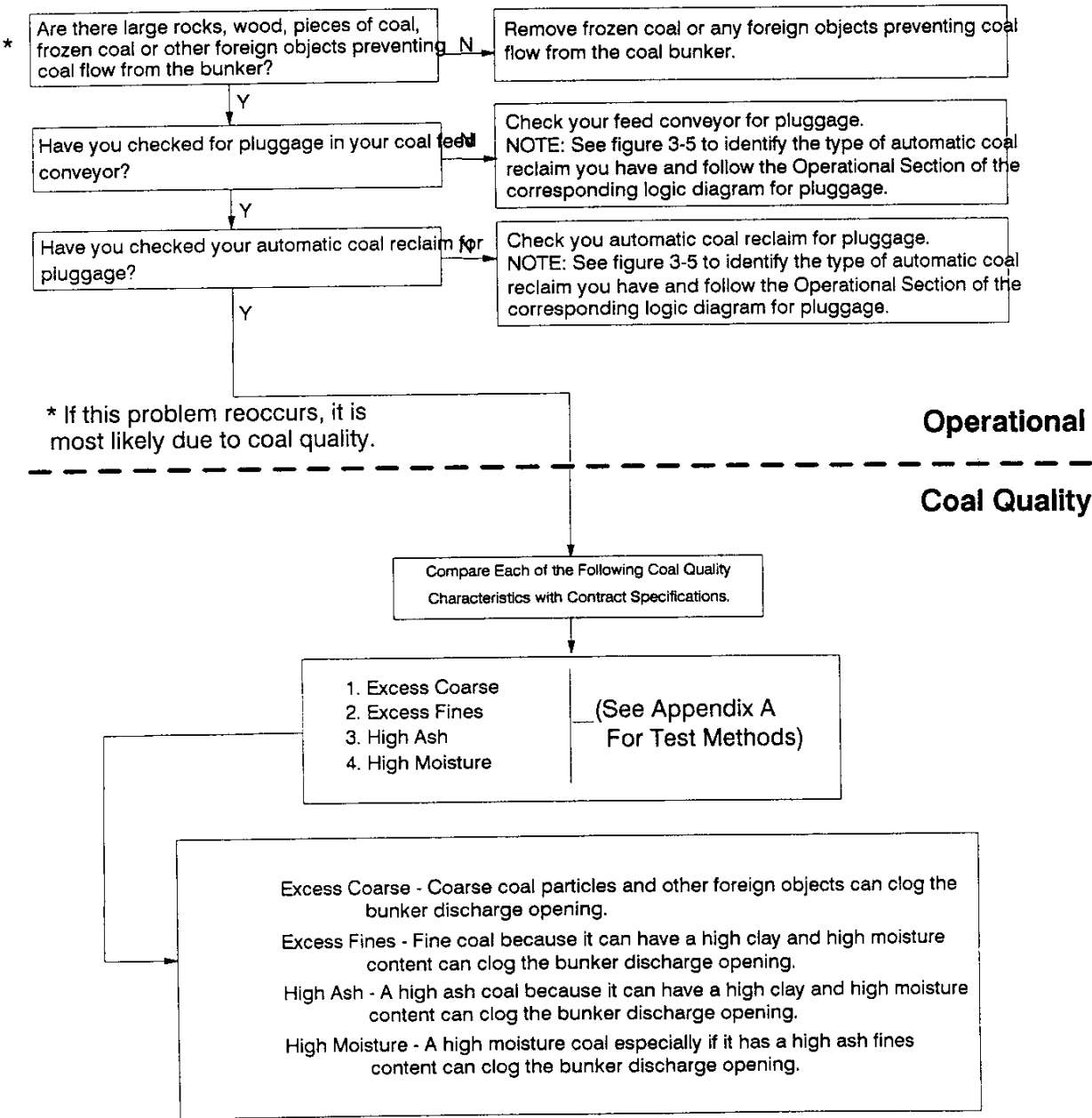


FIG3-44n/2

FIGURE 3-45: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Insufficient Capacity In The Bunker

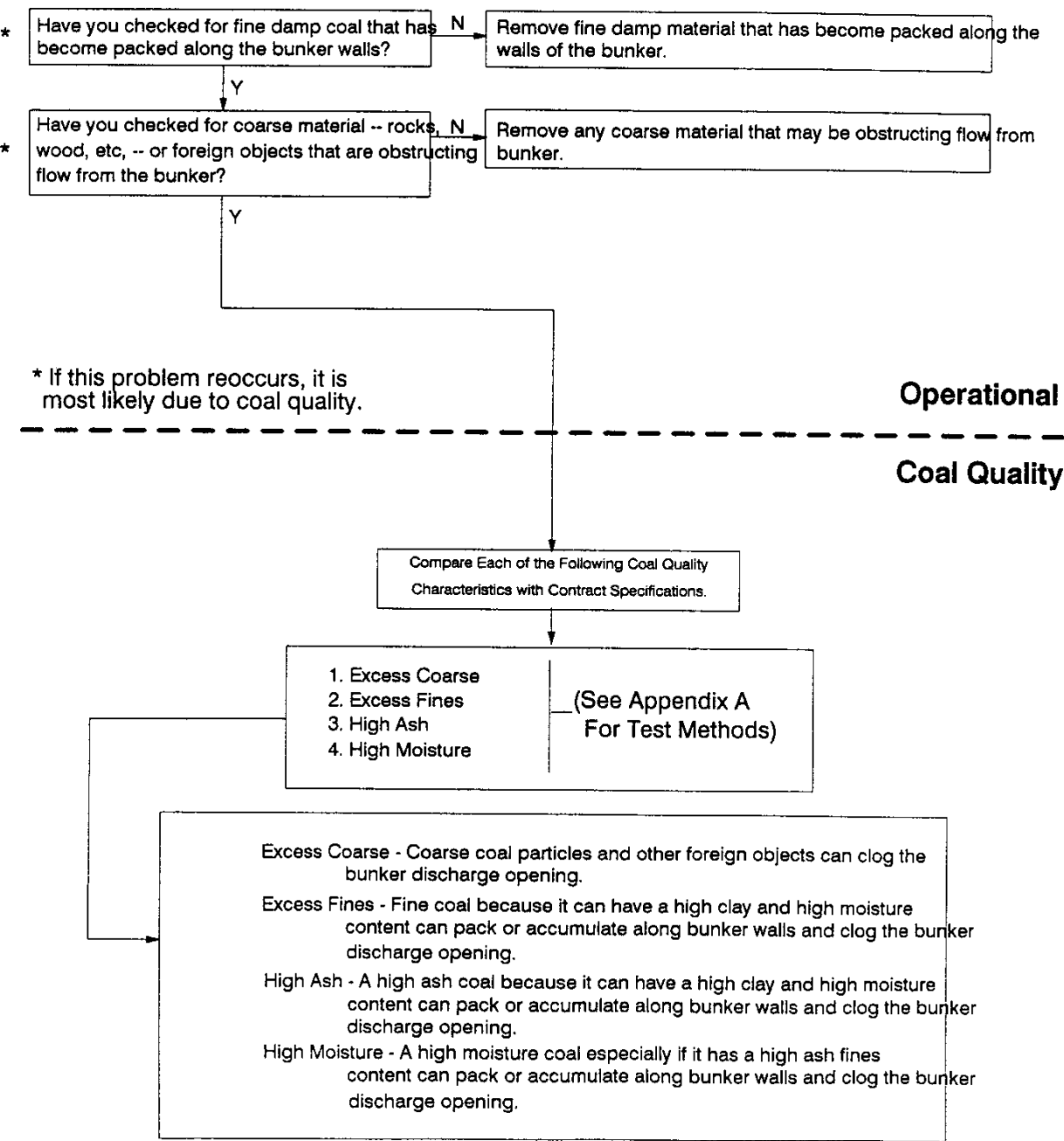


FIG3-45r/2



FIGURE 3-46: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Erratic Feeding From The Coal Bunker

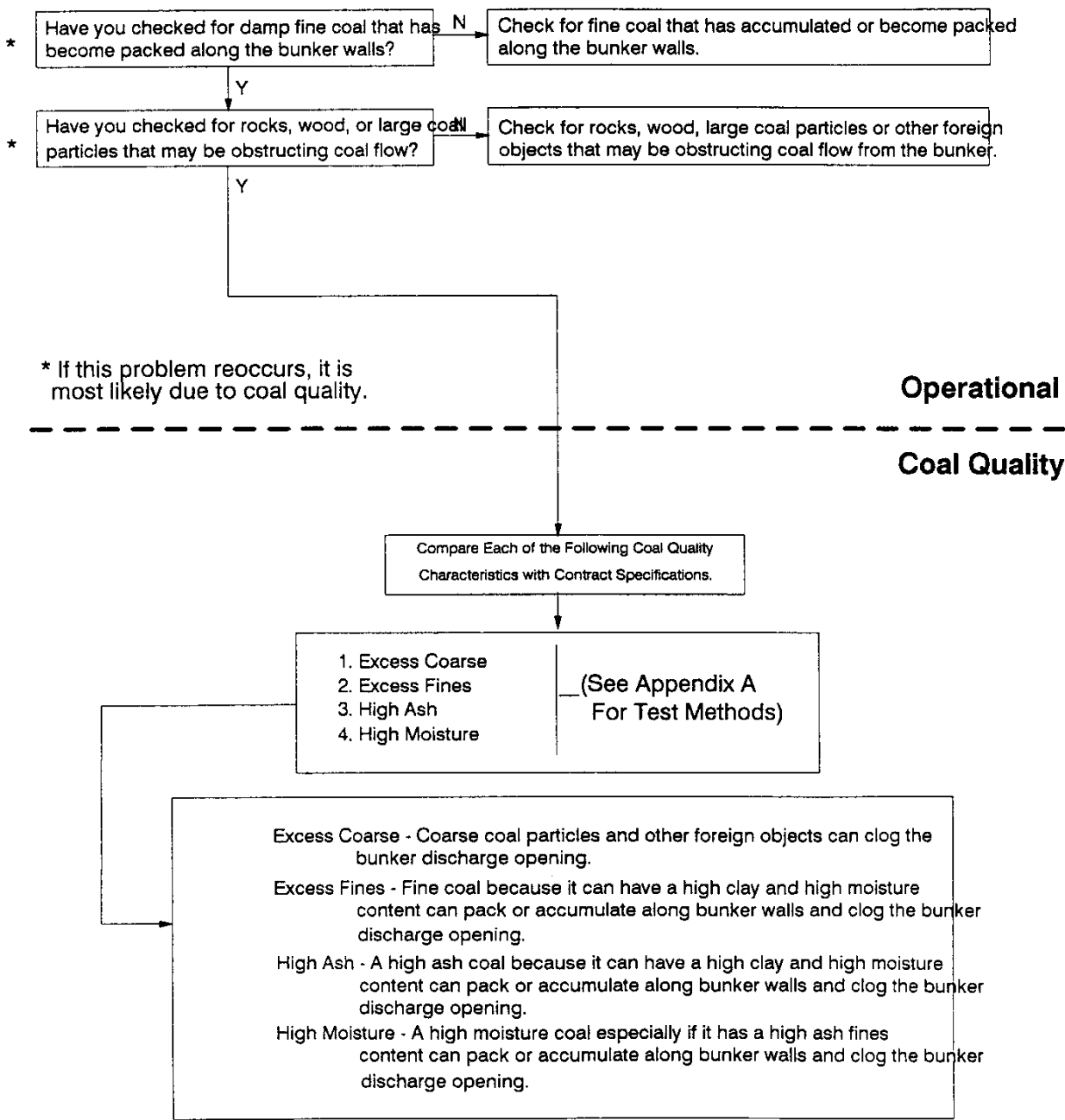


FIG3-46n/2

FIGURE 3-47: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Pluggage In The Coal Hopper

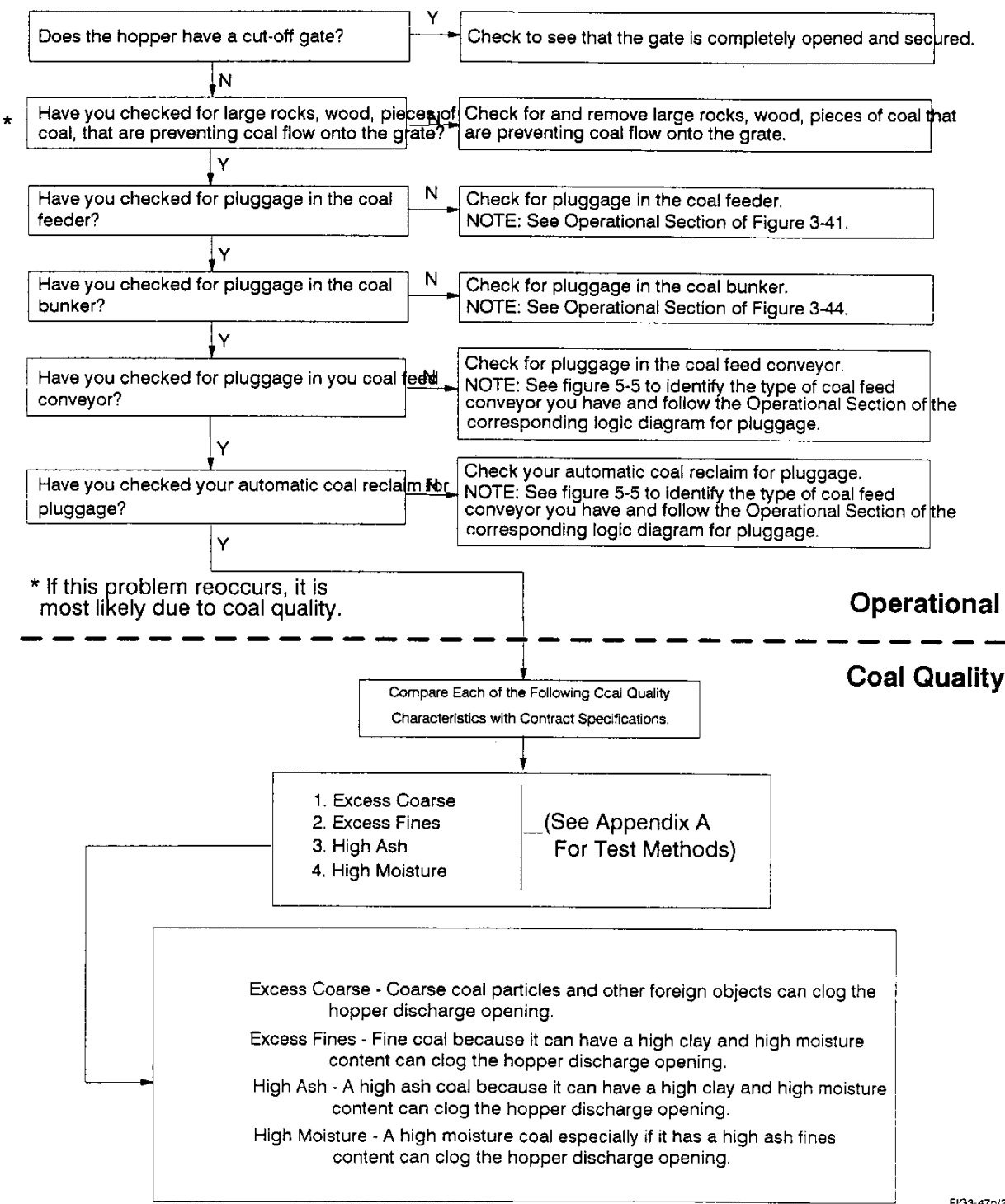


FIG3-47n/2

FIGURE 3-48: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM

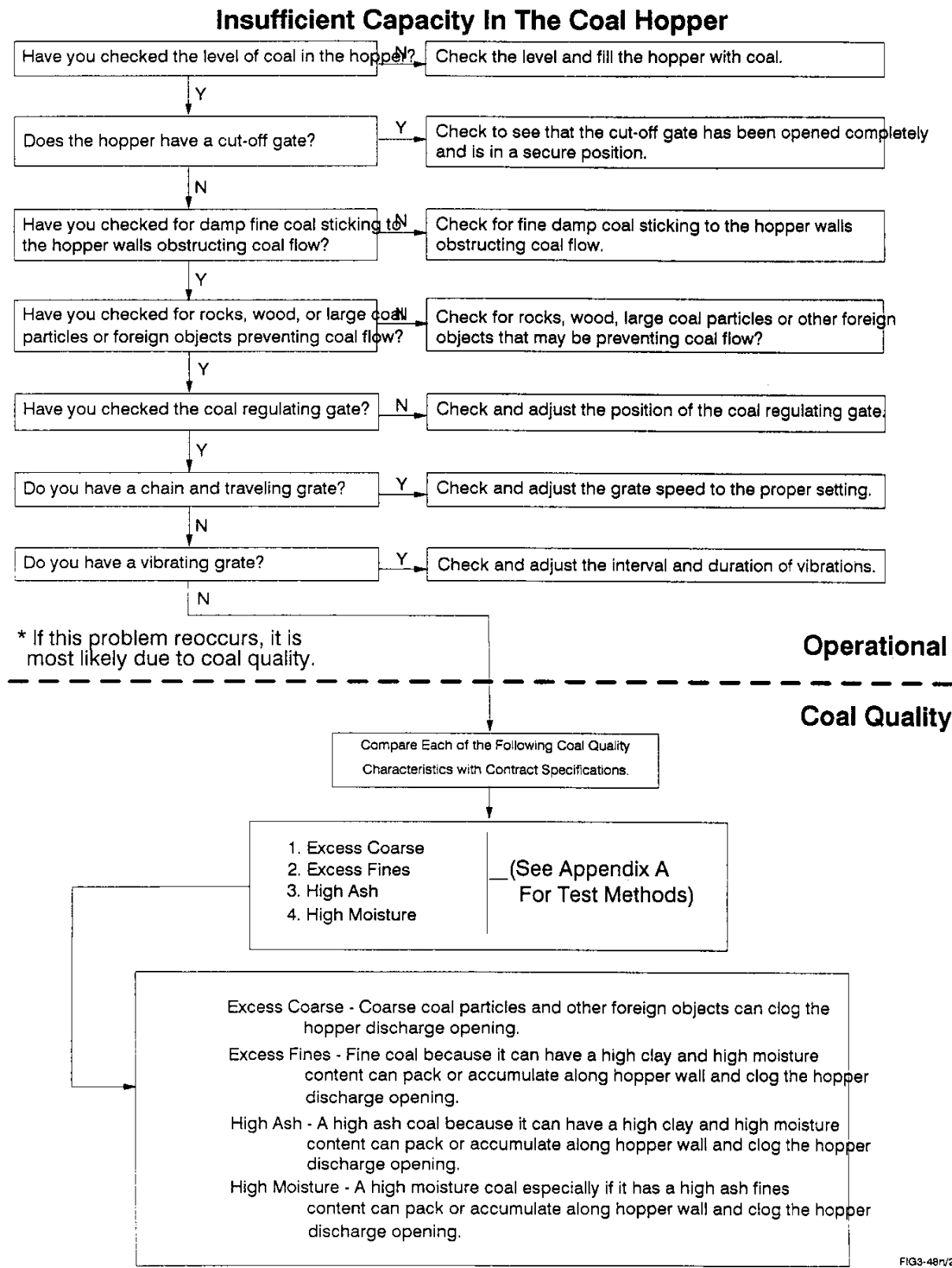


FIG3-48r/2

FIGURE 3-49: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Erratic Feeding From The Coal Hopper

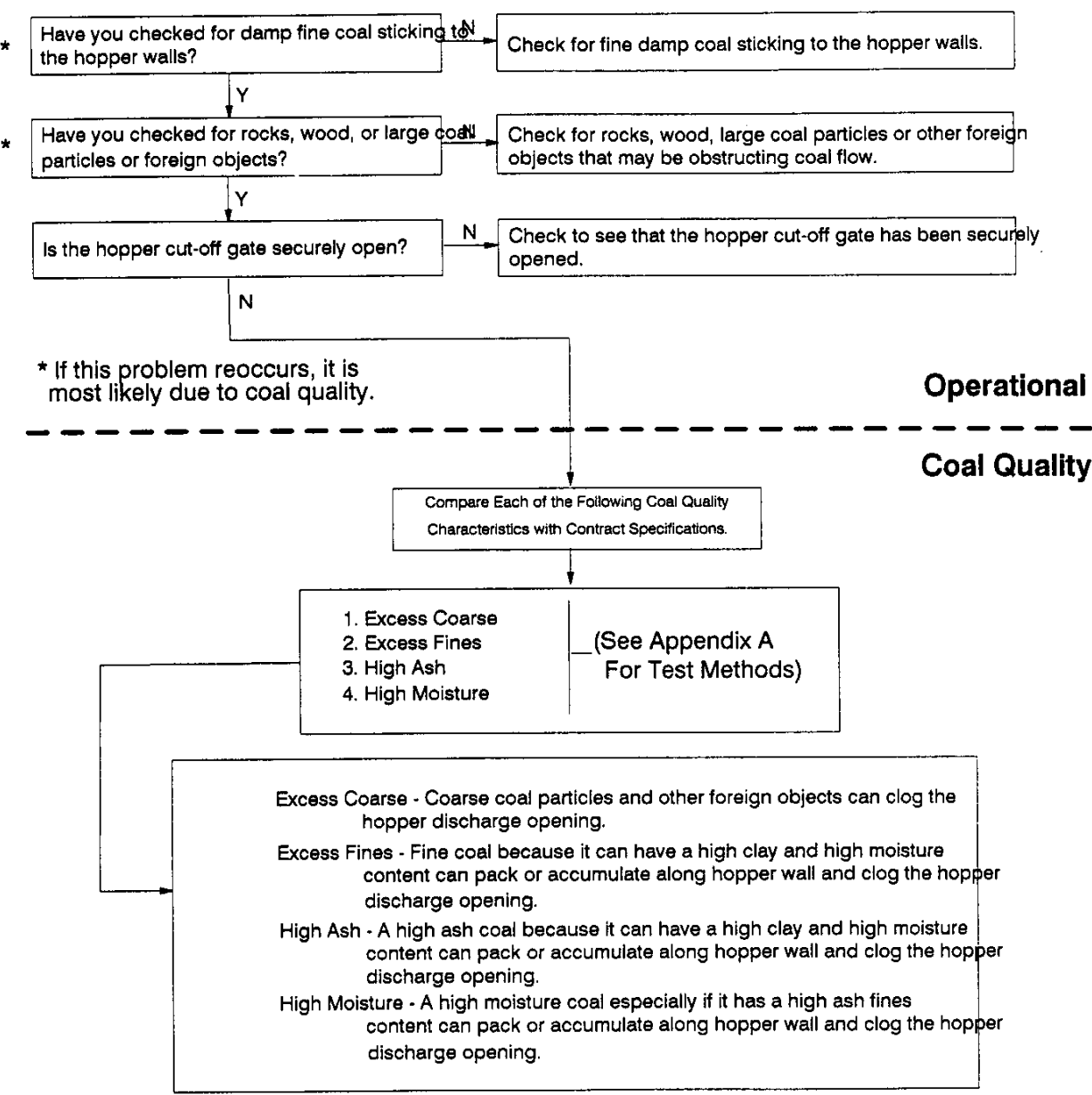


FIGURE 3-50: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Excess Wear Of The Feeder Distributor Mechanism

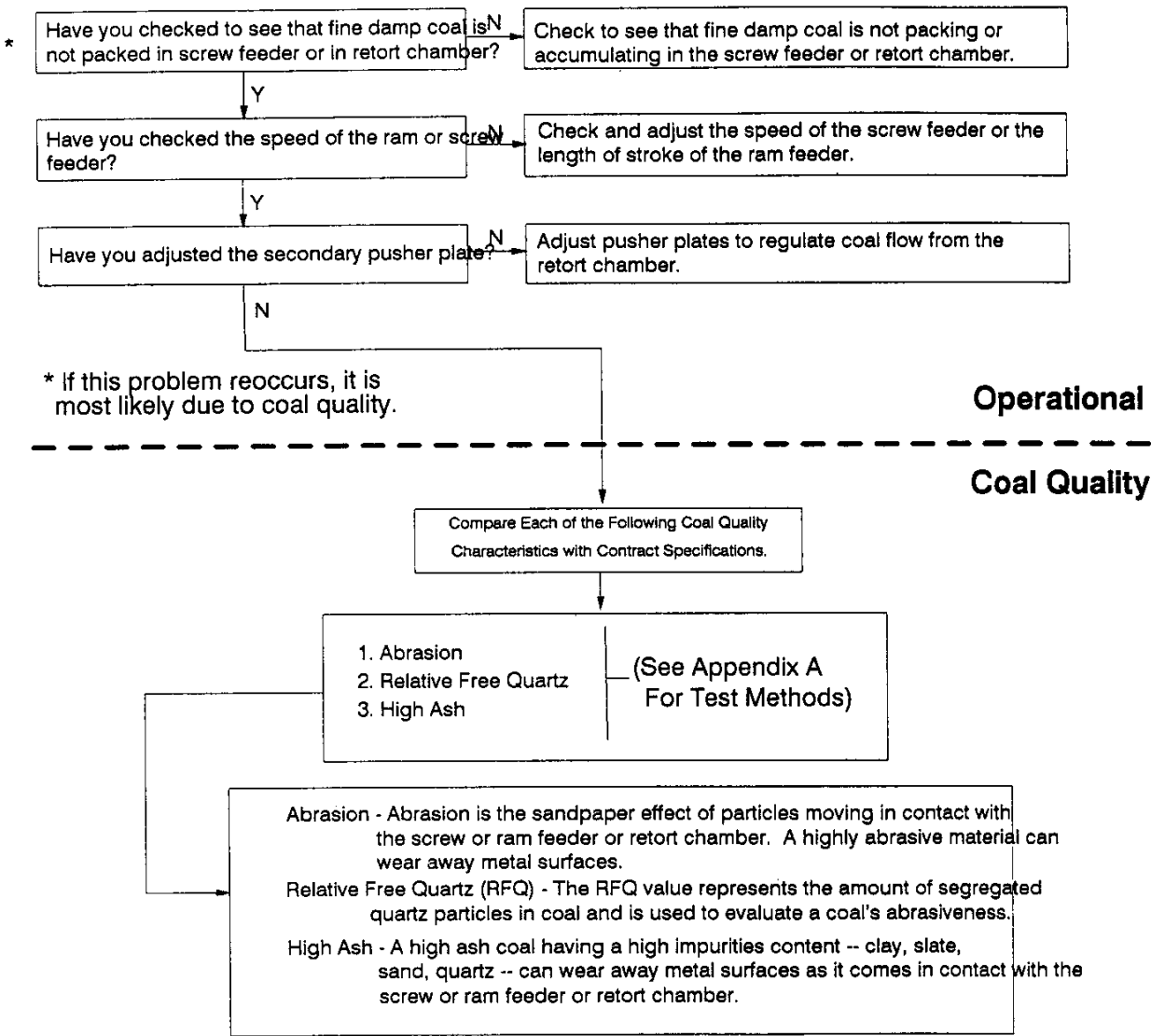


FIG3-50n/2

FIGURE 3-51: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Pluggage In The Feeder Distributor Mechanism

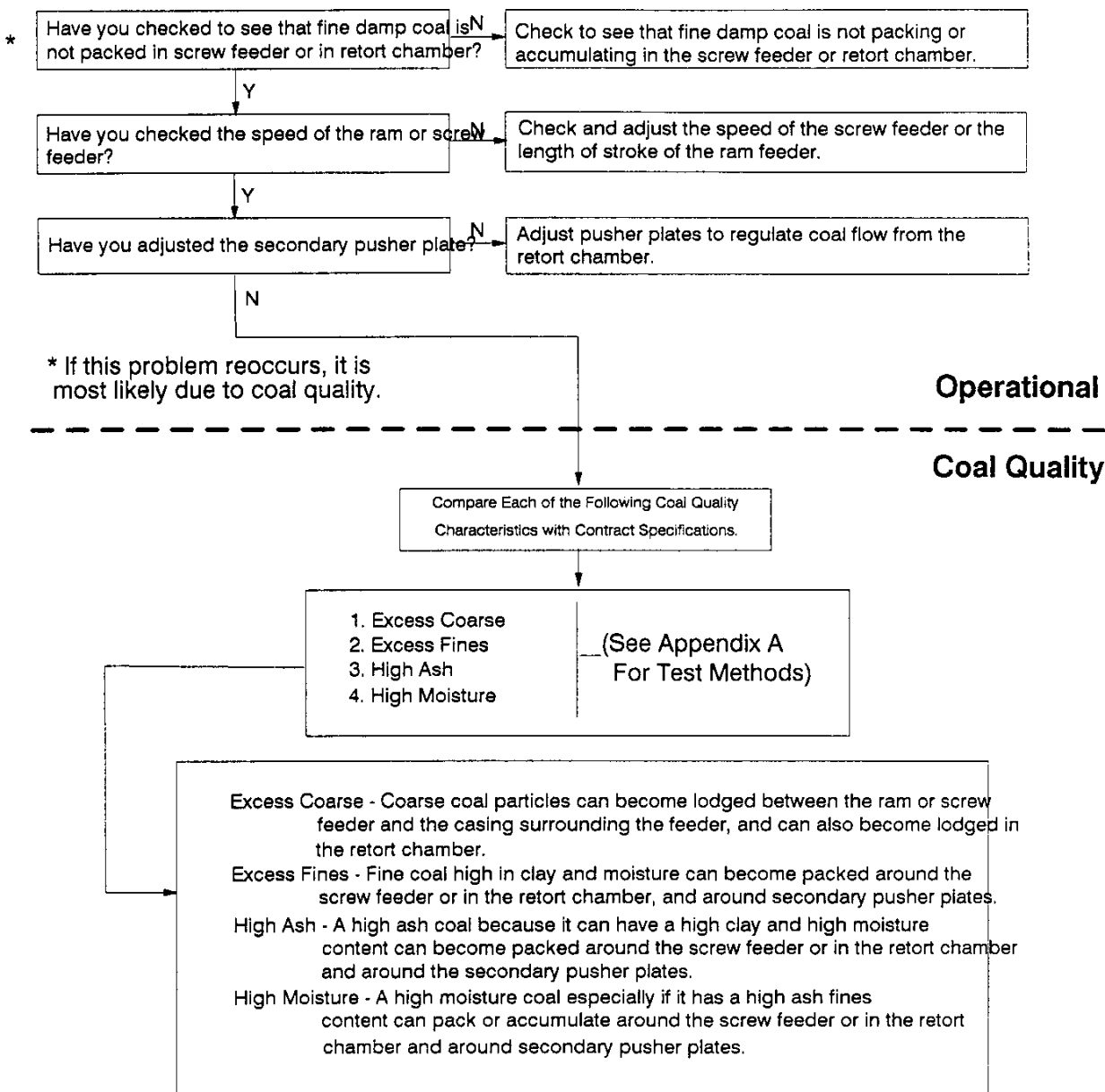


FIG3-51n/2

FIGURE 3-52: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Insufficient Capacity Of The Feeder Distributor Mechanism

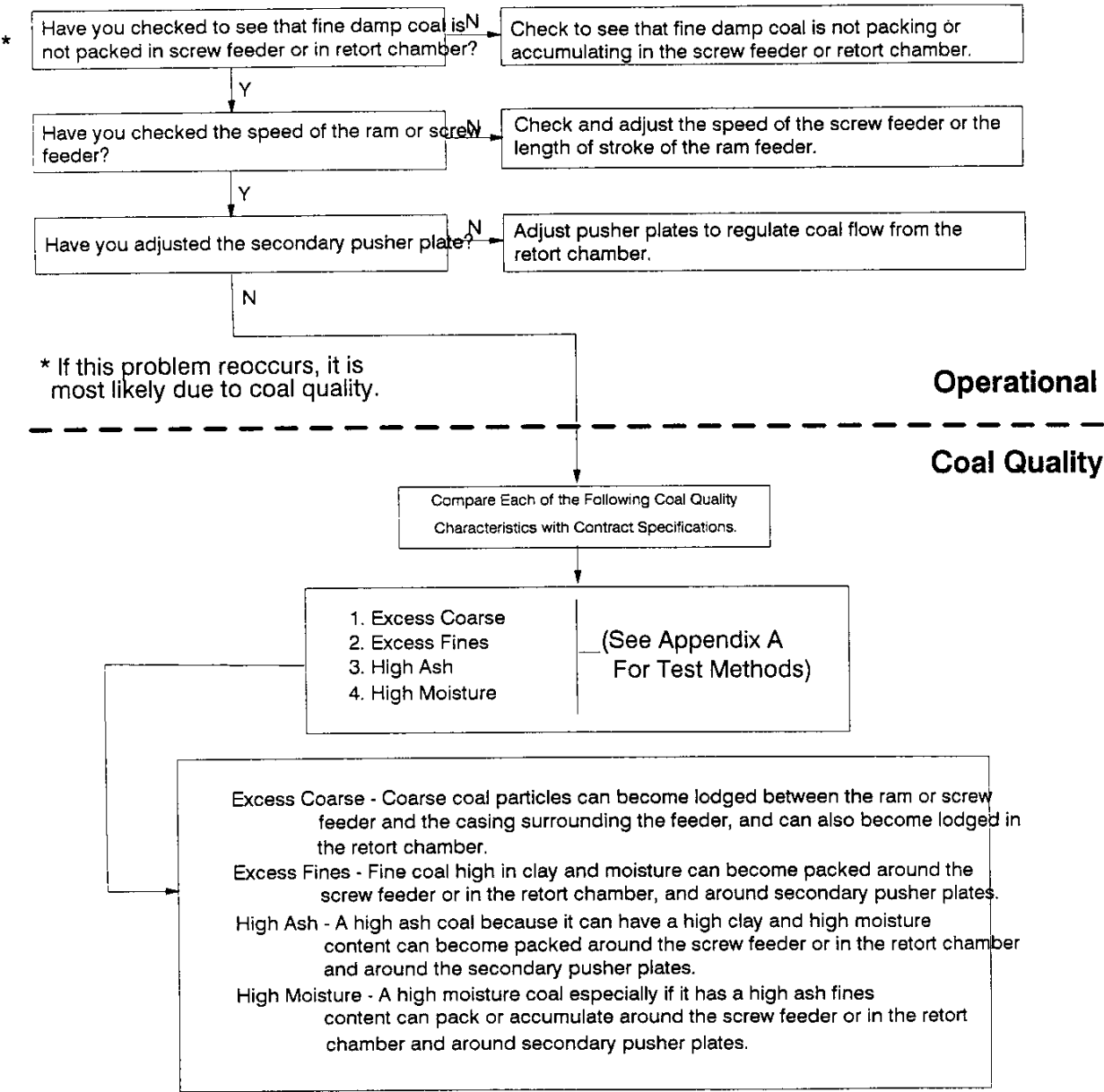


FIG3-52rv2

**FIGURE 3-53: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM**  
**For Erratic Feeding From The Feeder Distributor Mechanism**

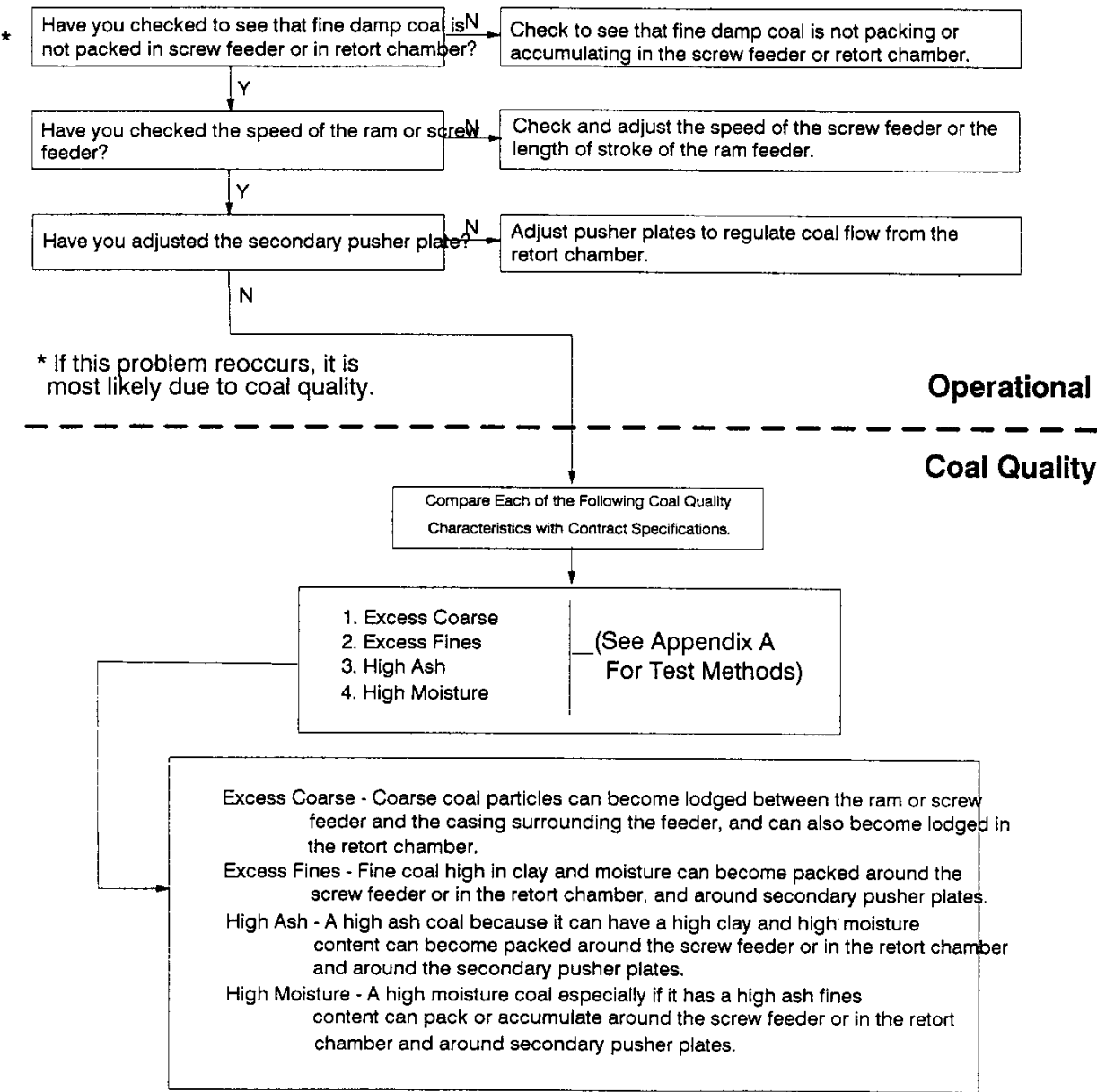


FIG3-53v2



FIGURE 3-54: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Insufficient Capacity And Inability To Meet Load  
(Boiler)

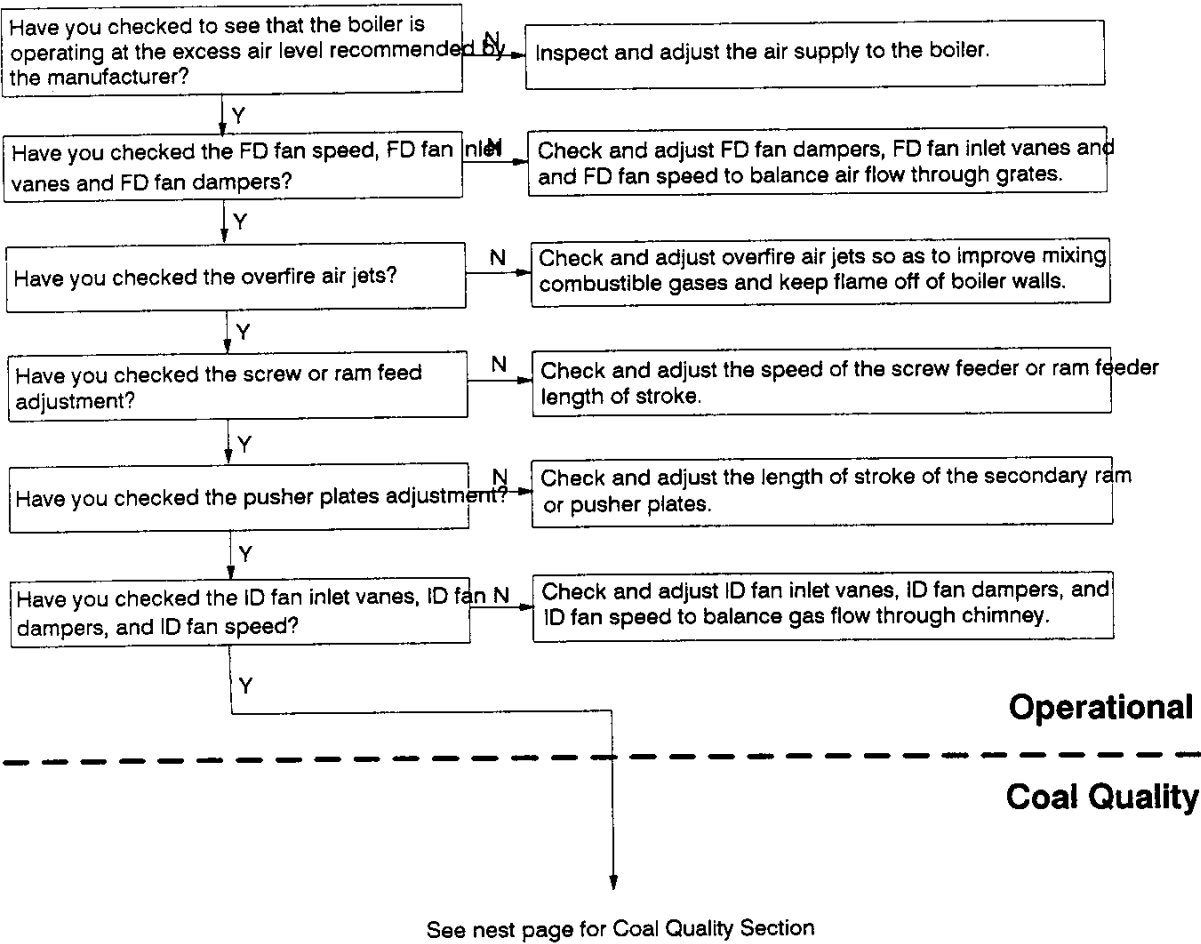


FIGURE 3-54 (continued): UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Insufficient Capacity And Inability To Meet Load  
(Boiler)

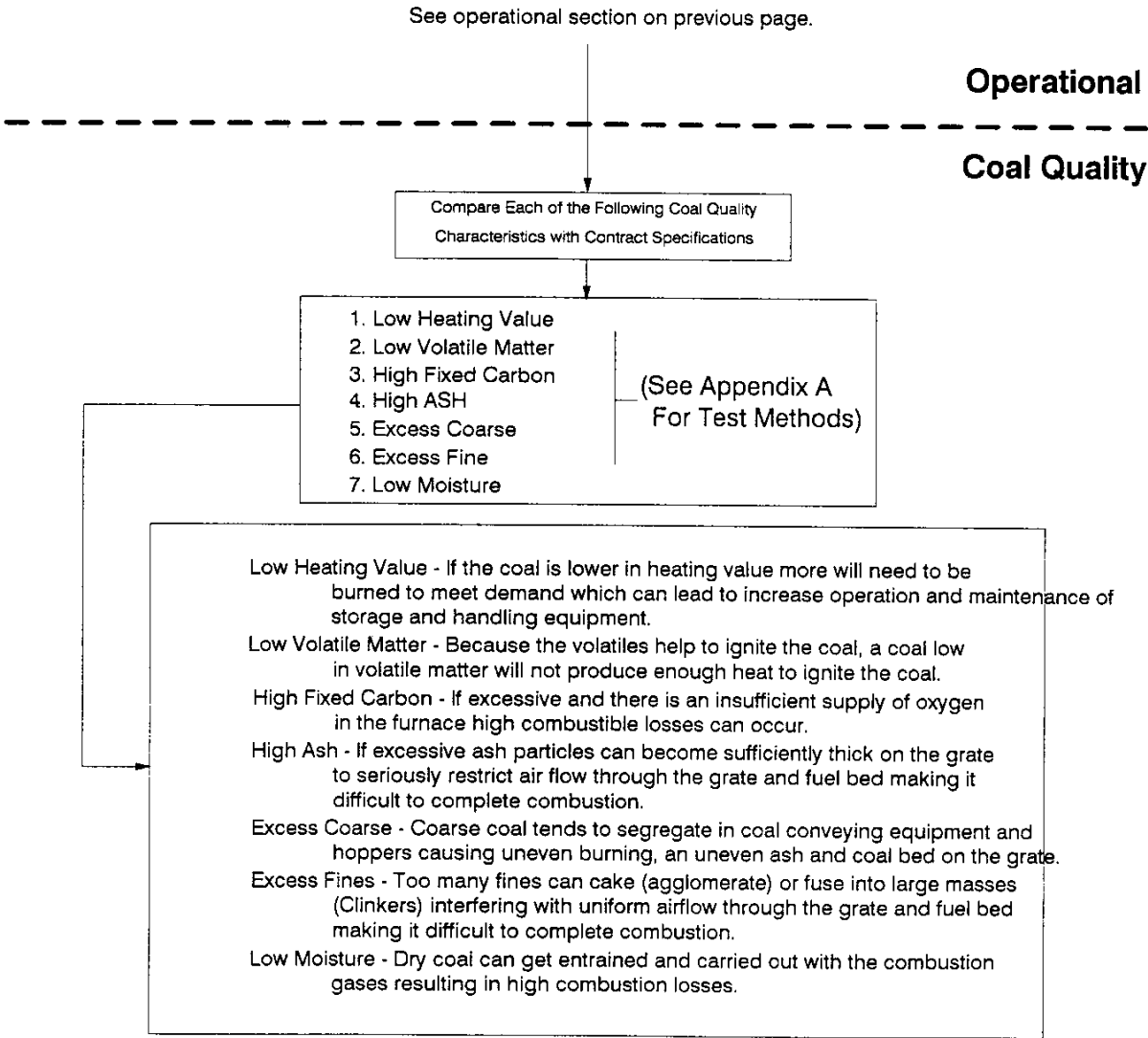


FIG3-54nb/2

FIGURE 3-55: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Reduced Boiler Efficiency

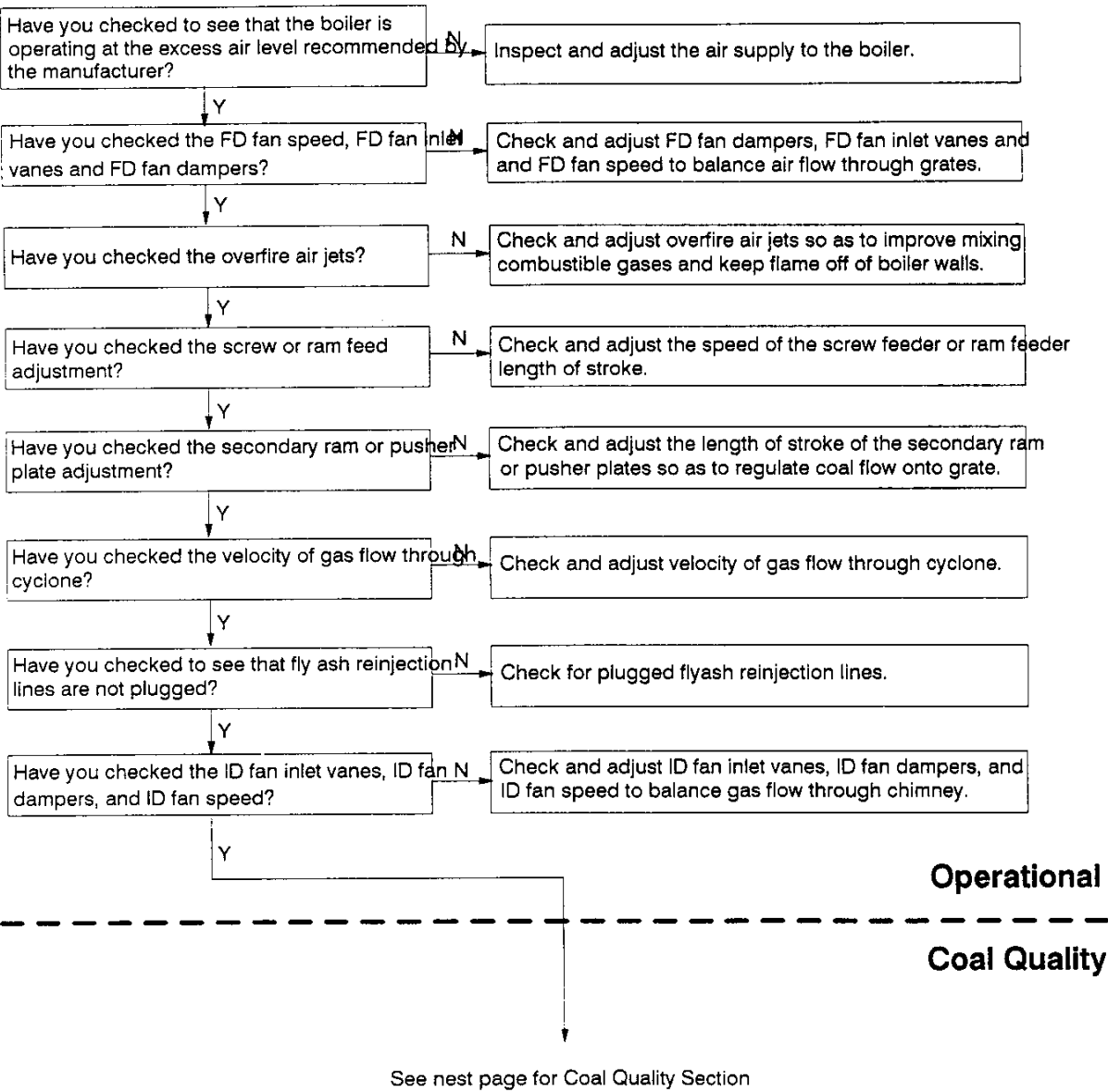


FIGURE 3-55 (continued): UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Reduced Boiler Efficiency

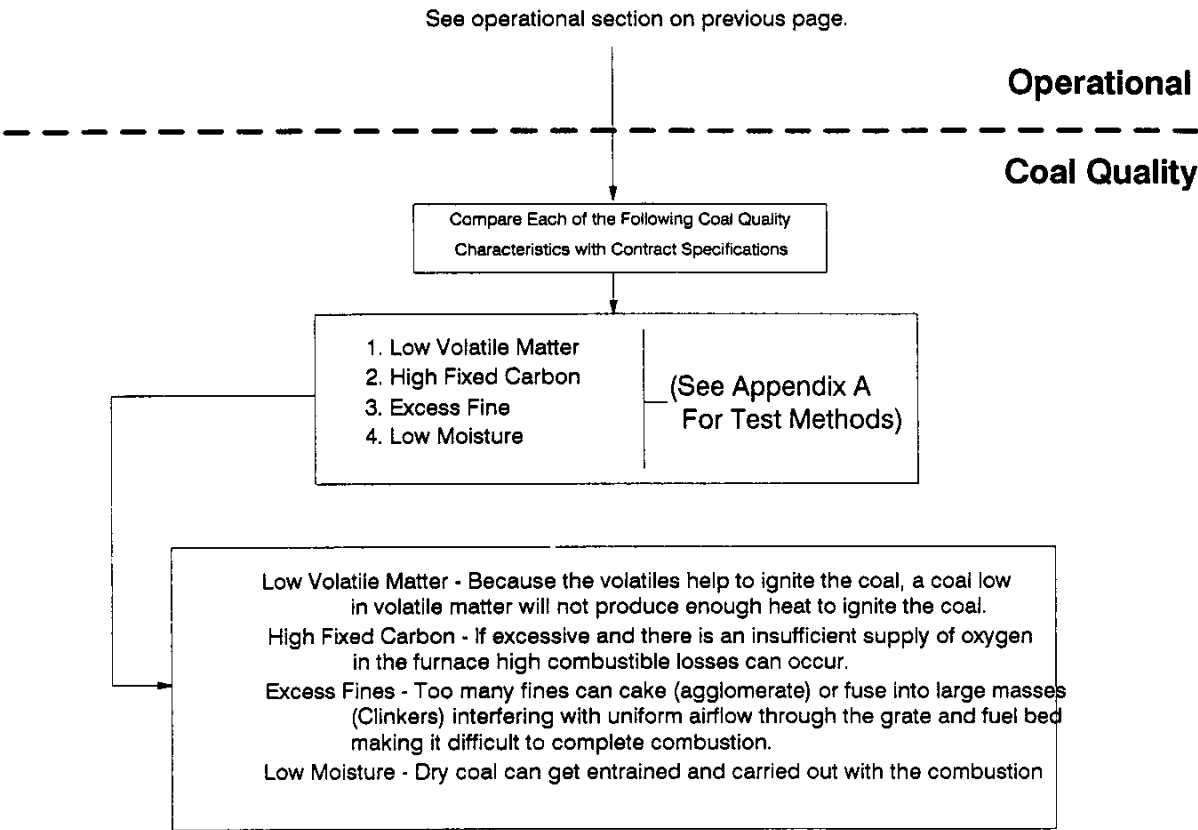


FIGURE 3-56: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Corrosion On The Grate

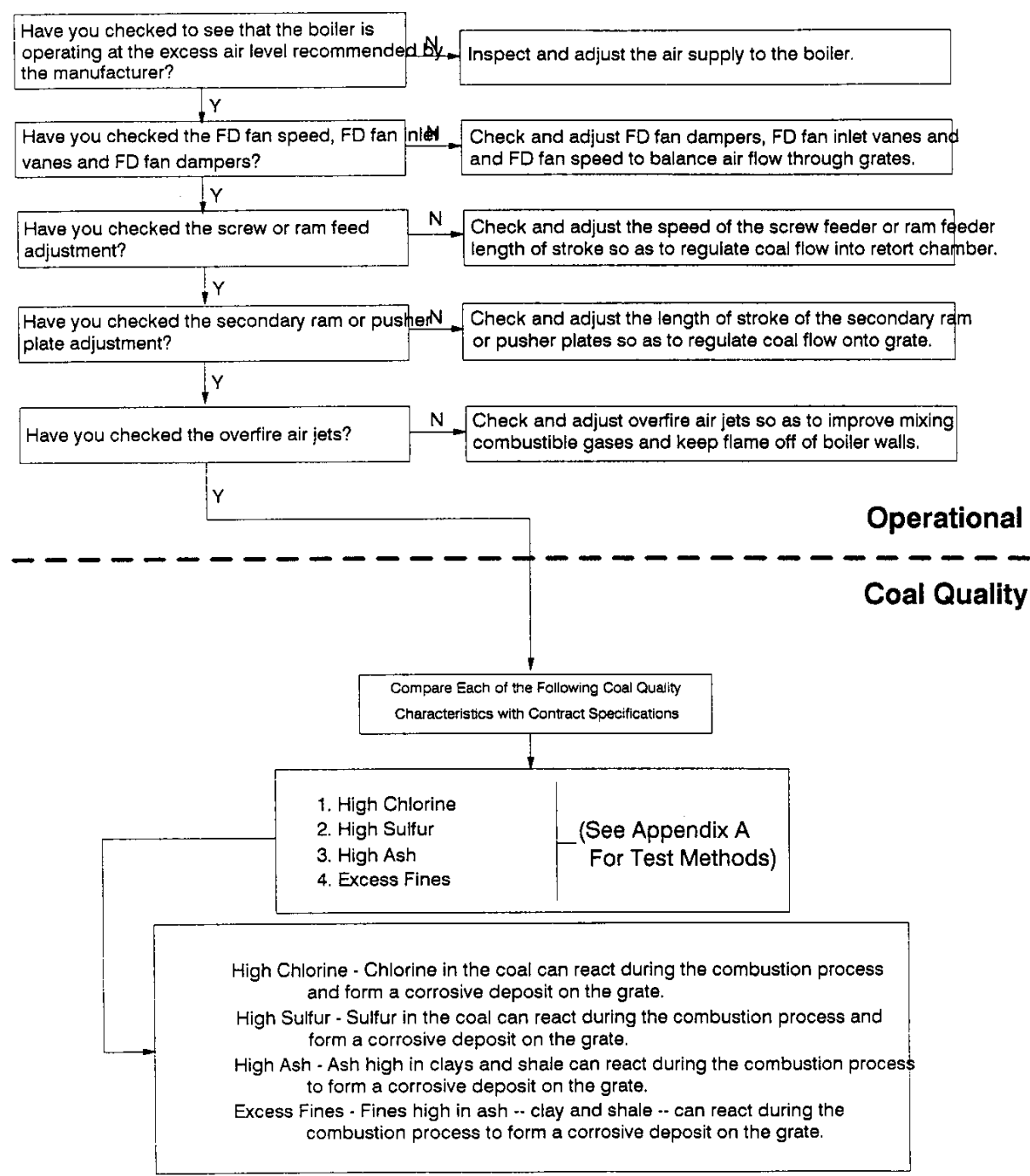


FIG3-56r/2

FIGURE 3-57: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Segregation On The Grate

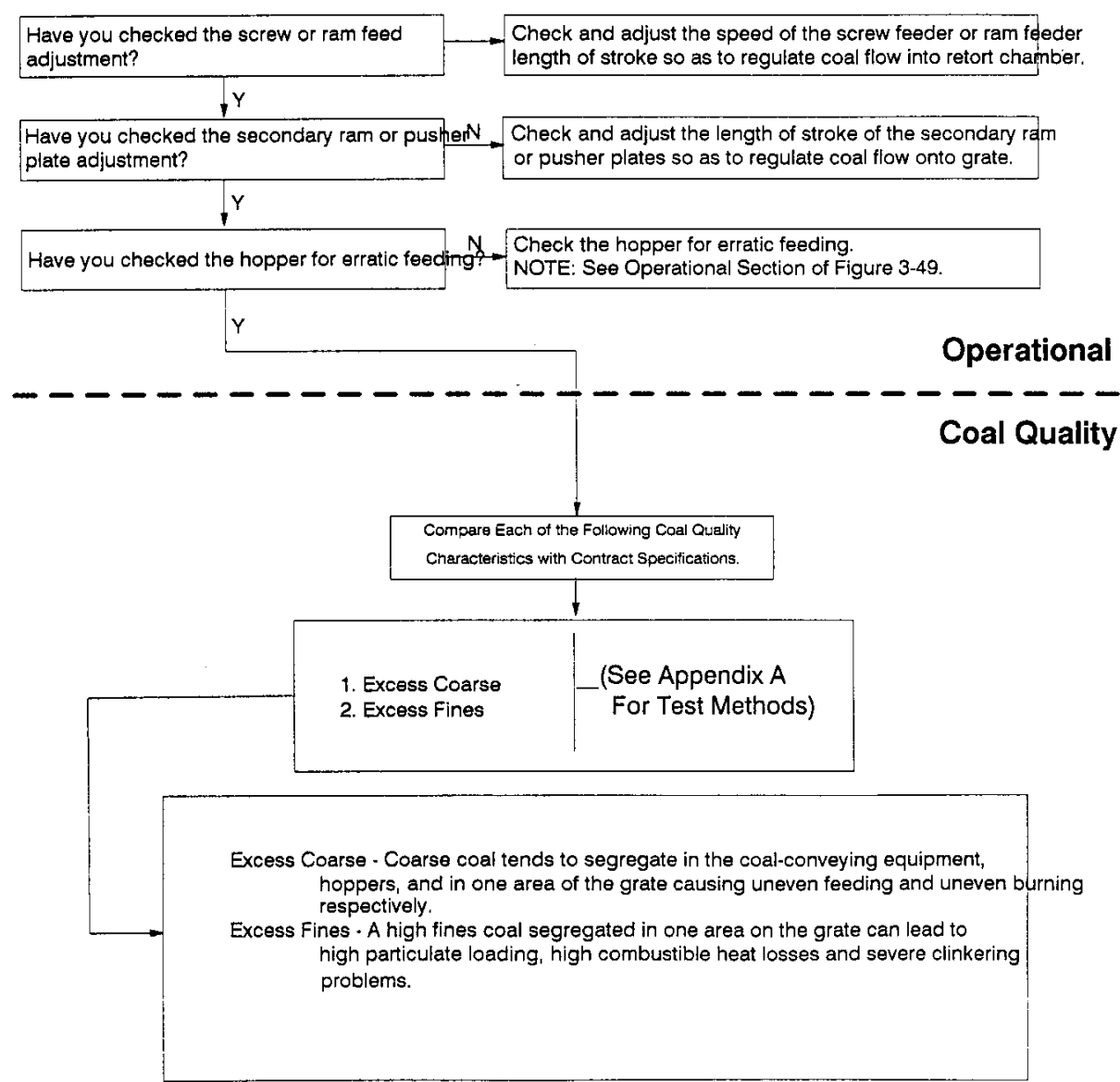


FIG3-57n/2

FIGURE 3-58: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Pressure Drop Across The Grate

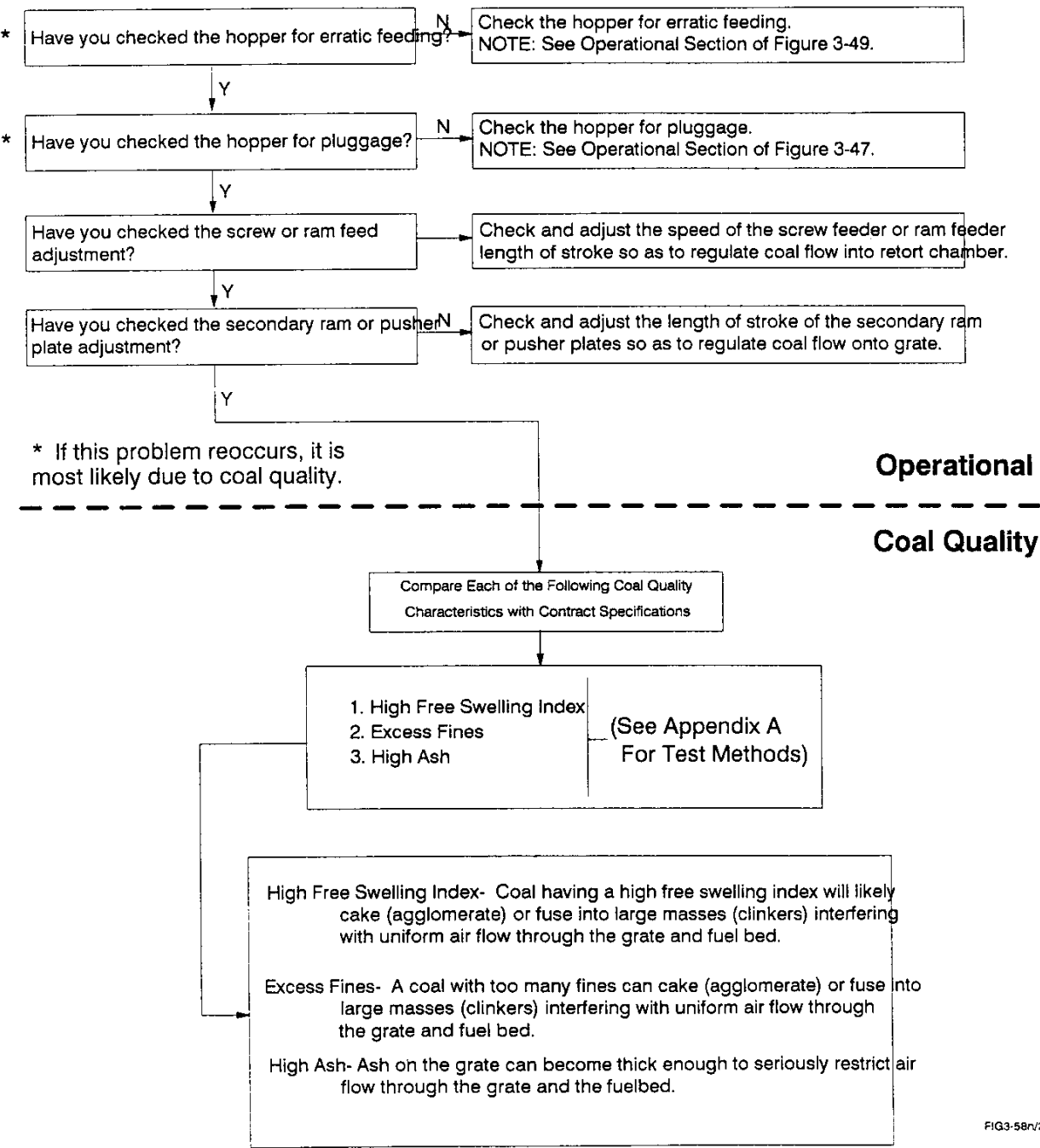


FIG3-58n/2

FIGURE 3-59: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Uneven Ashbed On The Grate

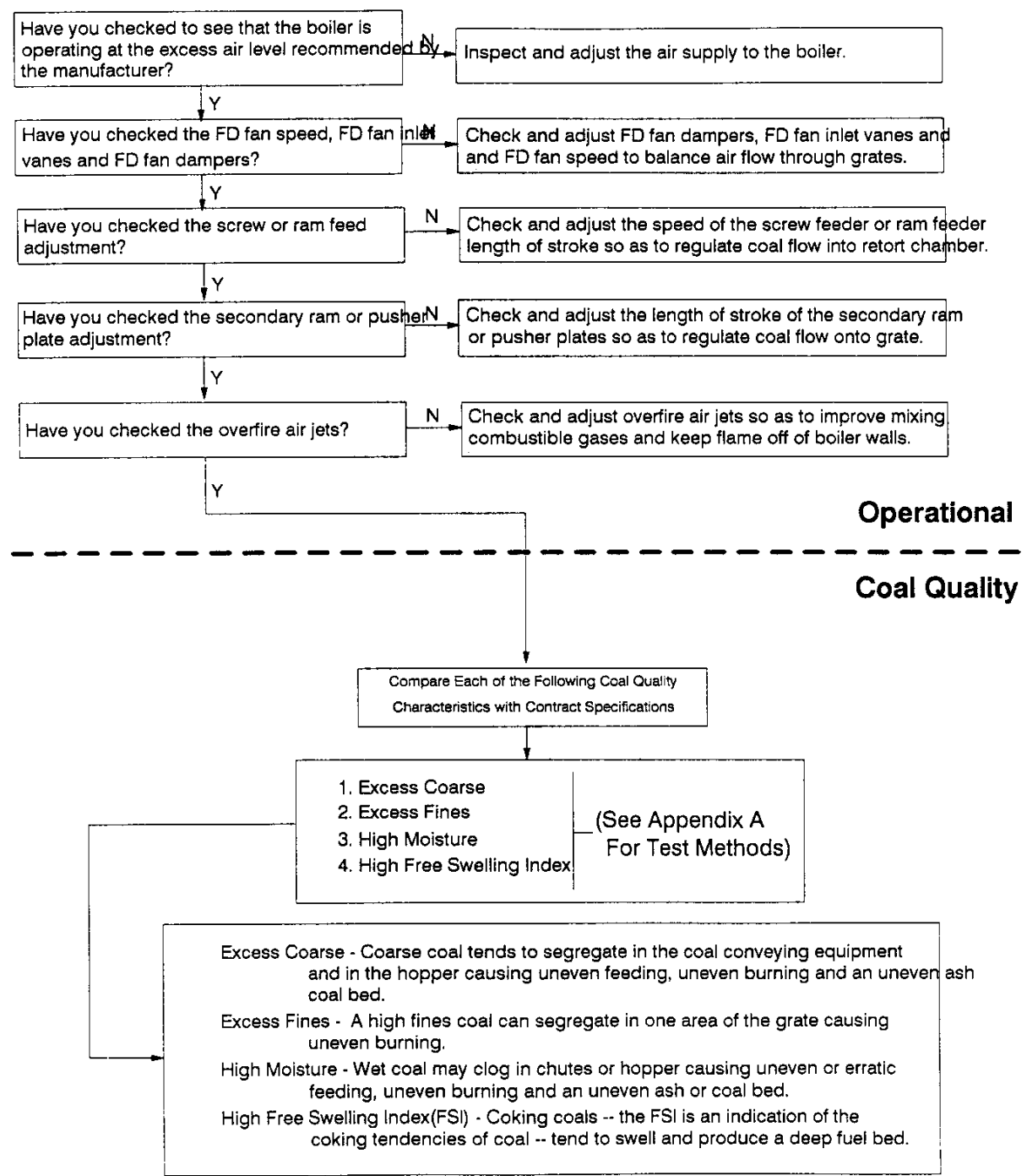


FIG3-59n/2



FIGURE 3-60: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Uneven Coalbed On The Grate

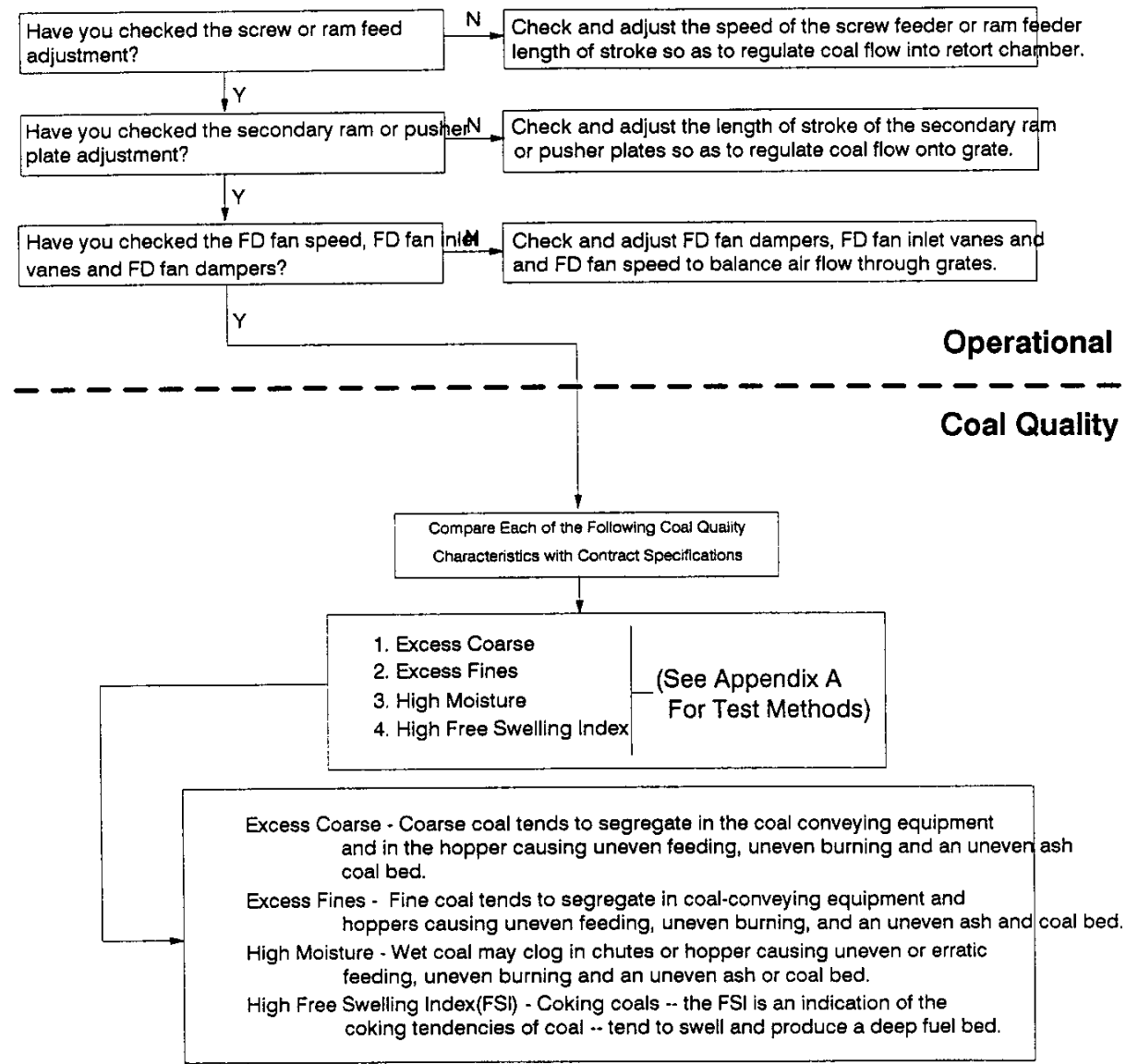


FIGURE 3-61: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Uneven Burning On the Grates

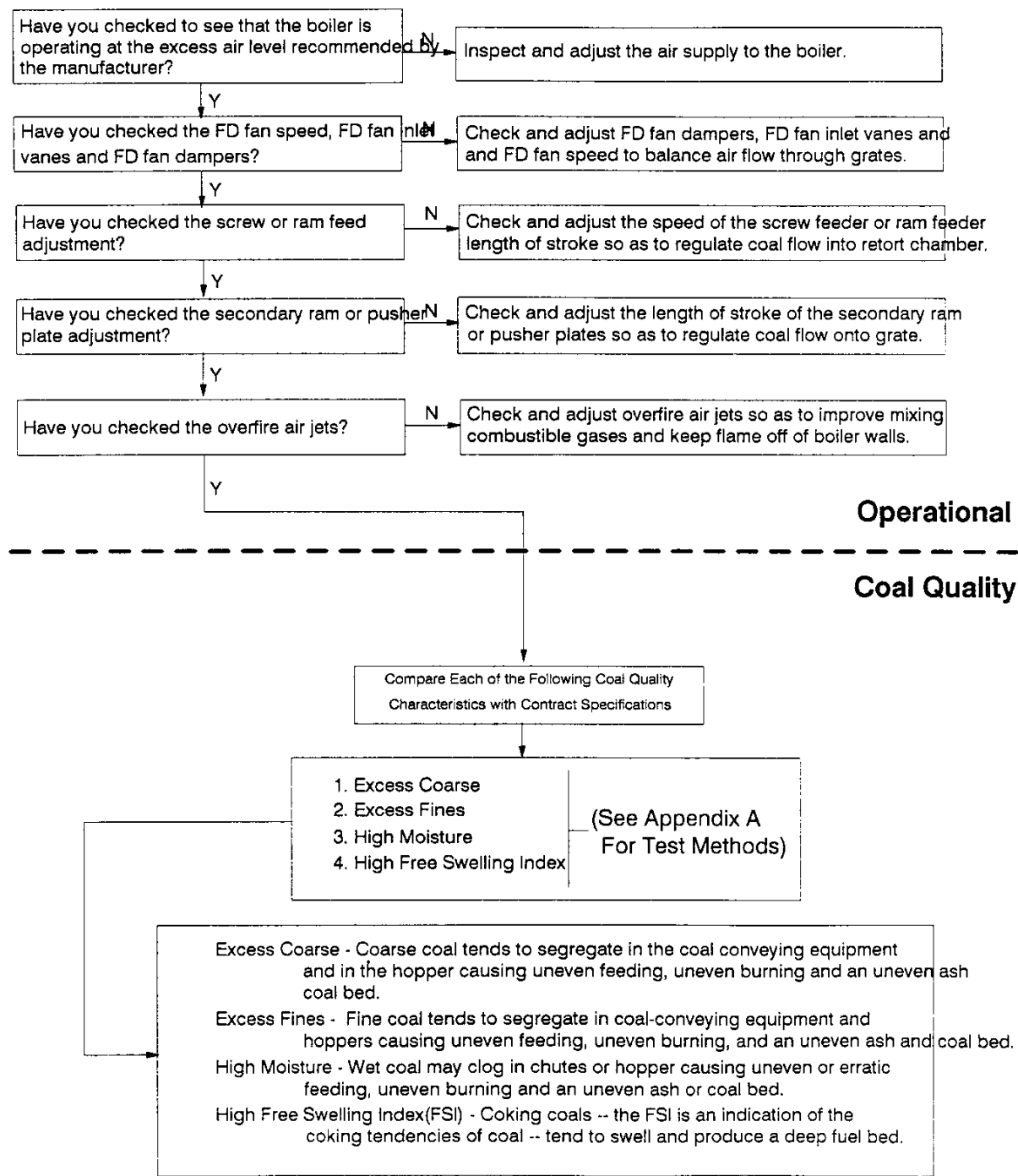


FIG3-61n/2

FIGURE 3-62: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Warped, Burnt, Cracked Grates

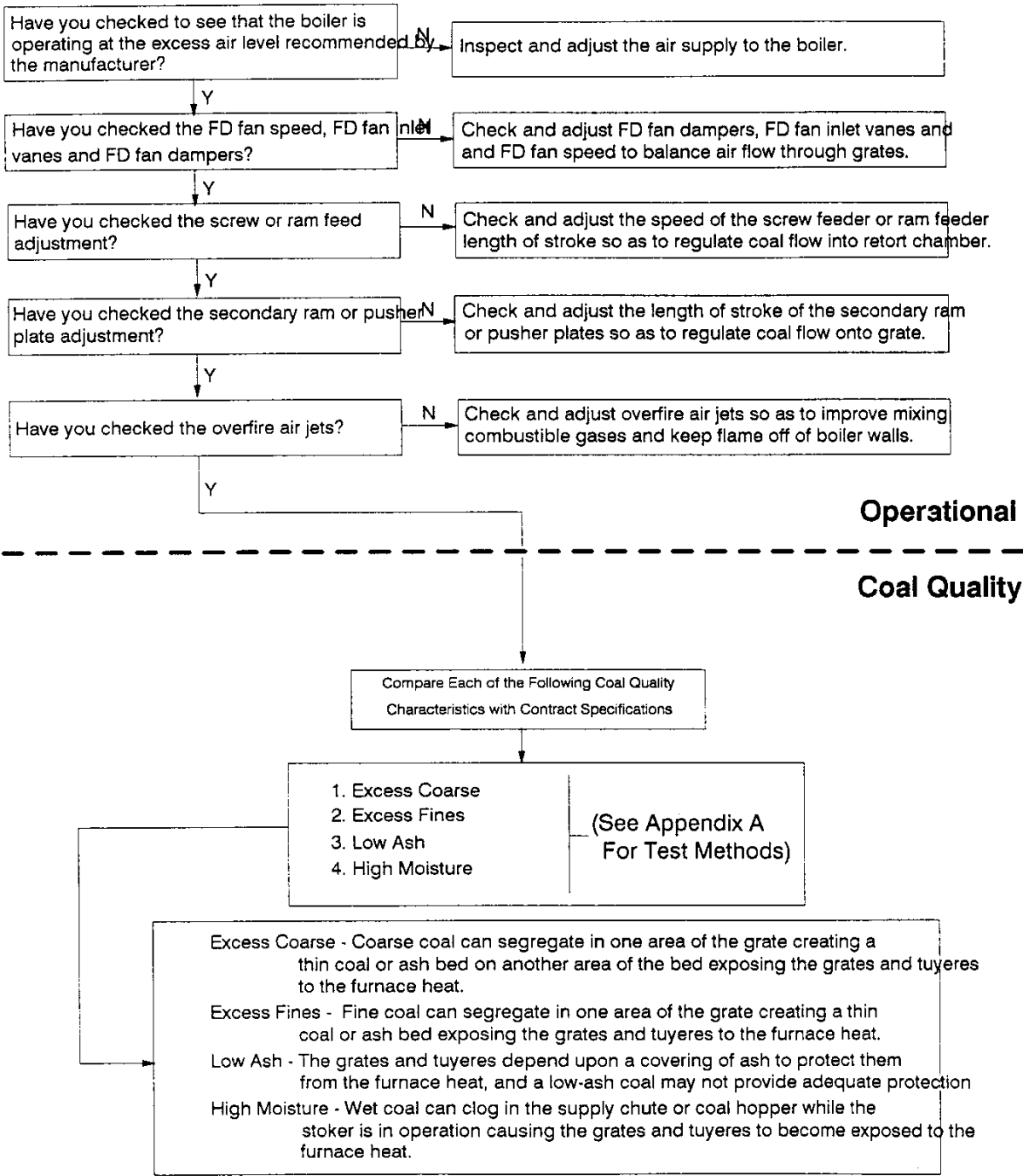


FIG3-62n/2

FIGURE 3-63: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Clinkers On The Grate

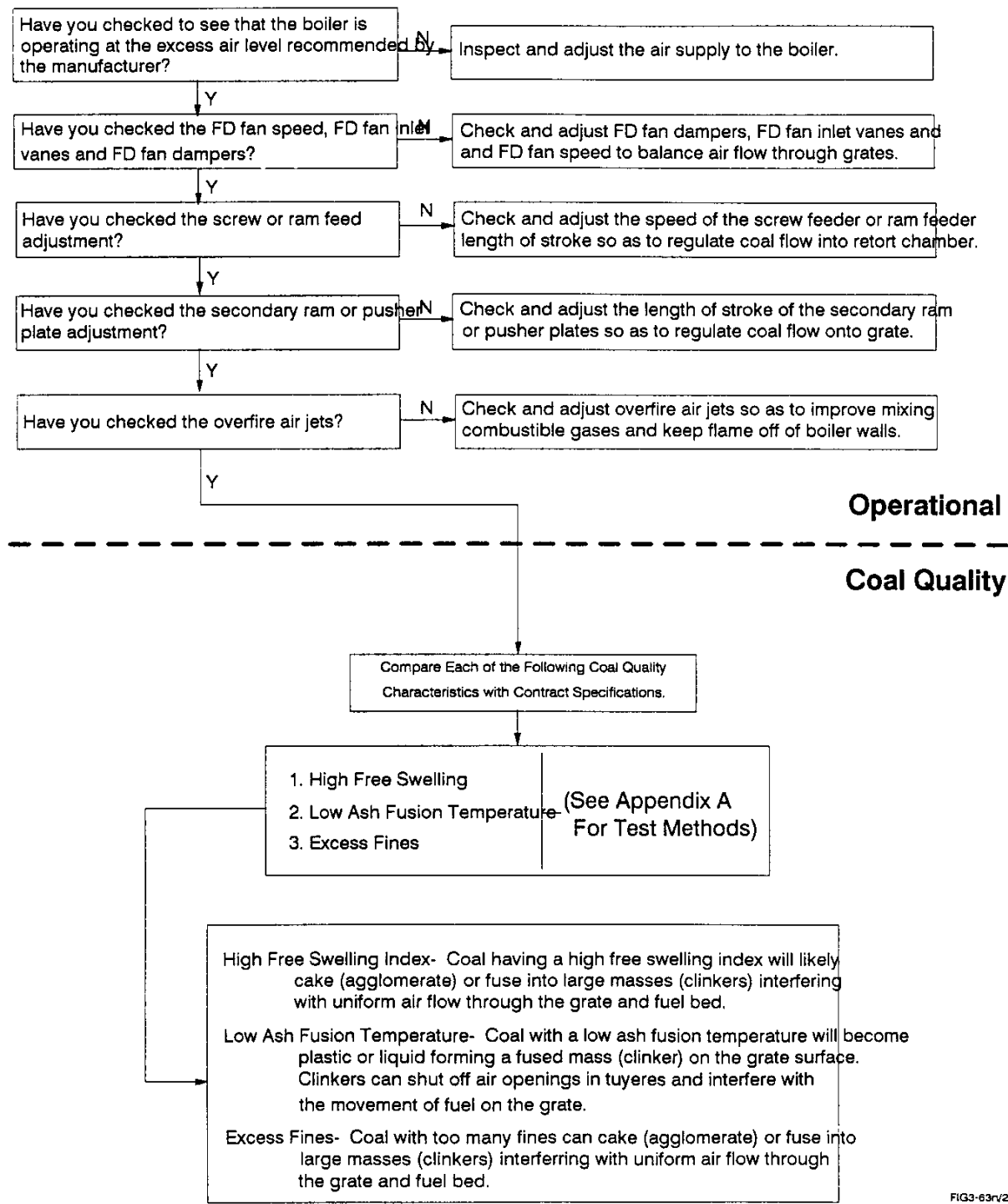


FIG3-63rv2

FIGURE 3-64: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Carbon Burnout On The Grate

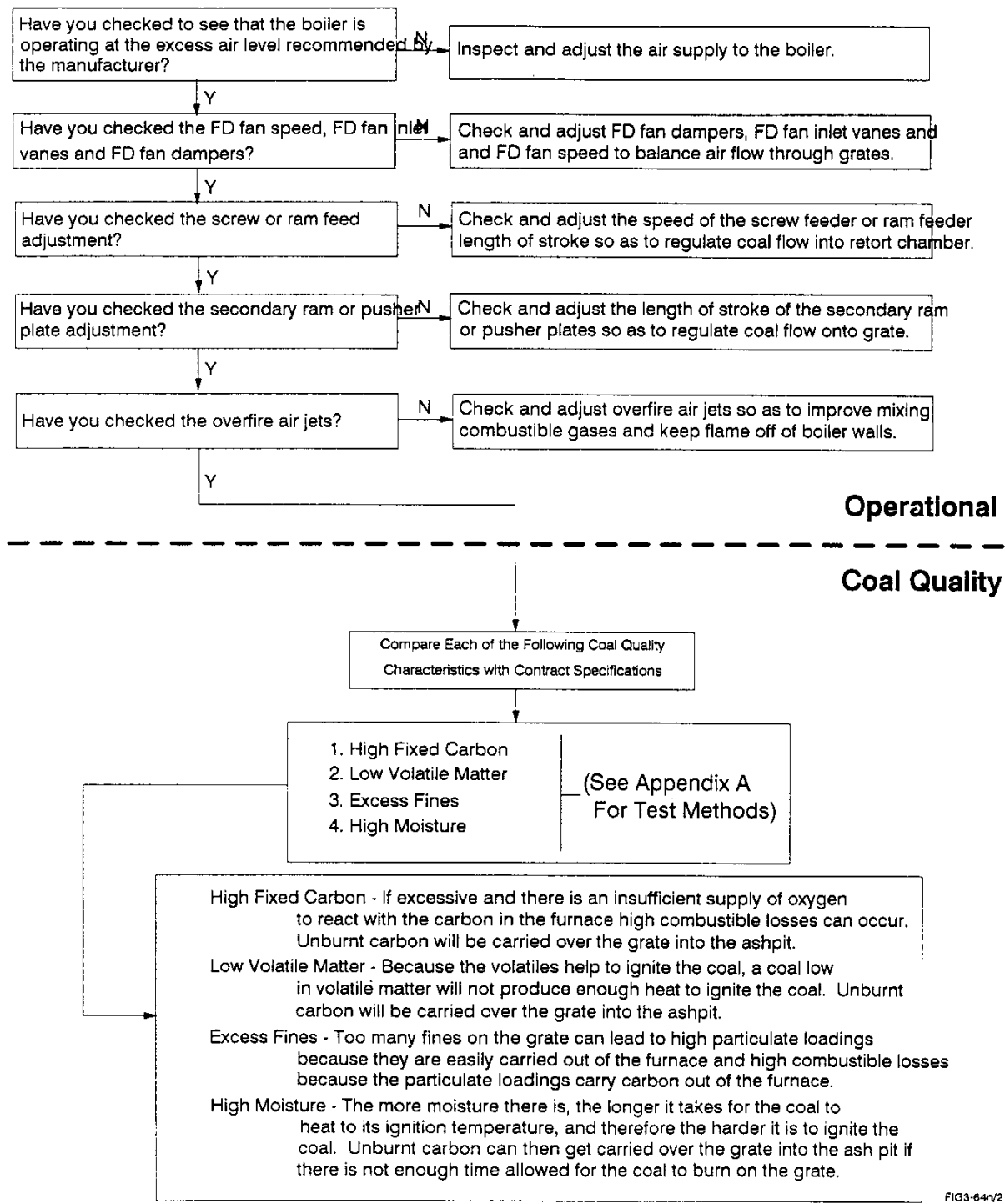


FIG3-64N/2

FIGURE 3-65: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Corrosion Of Heat Transfer Surfaces  
(Refractory Surfaces)

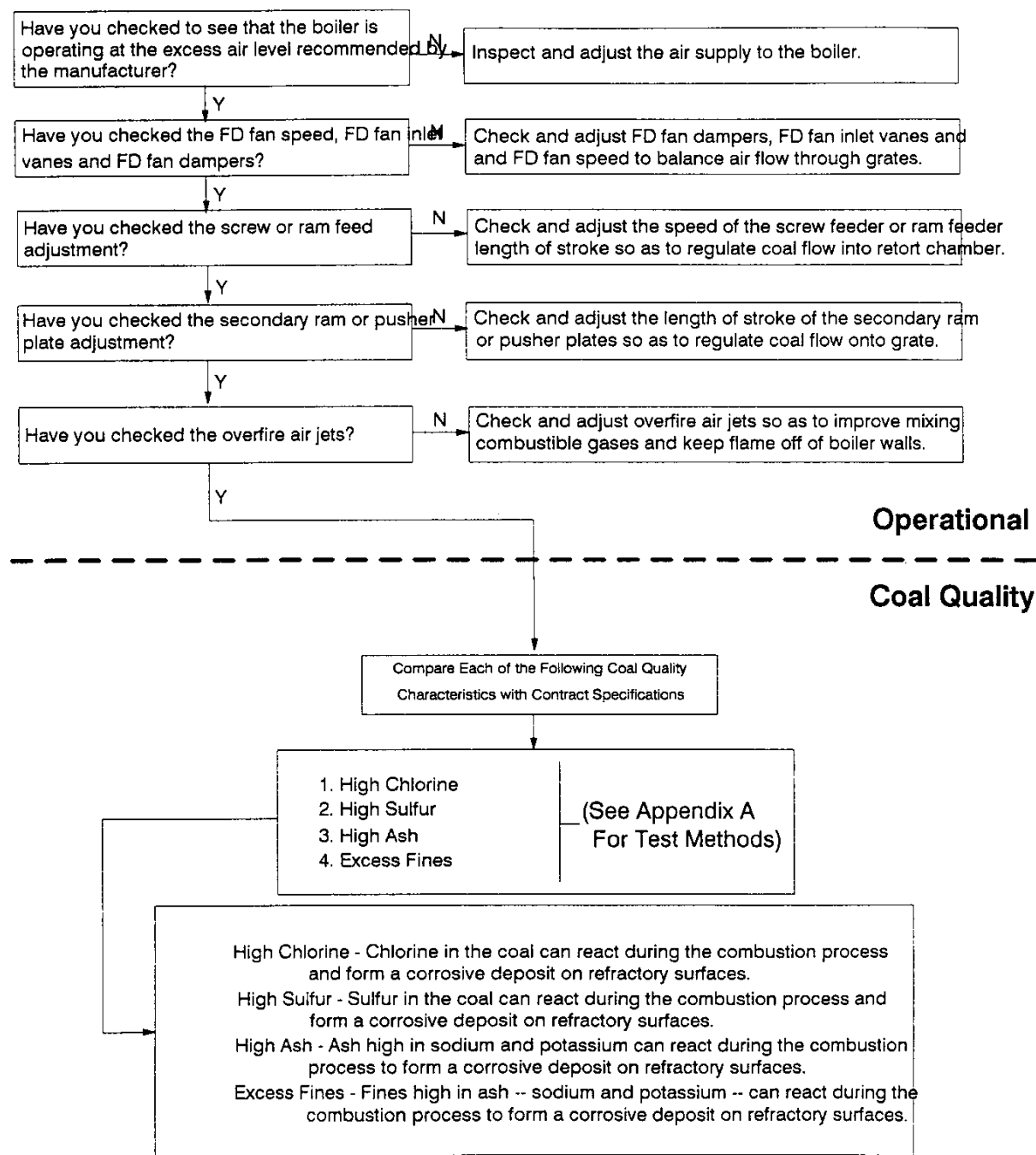


FIG3-65n/2

FIGURE 3-66: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Erosion Of Heat Transfer Surfaces  
(Refractory Surfaces)

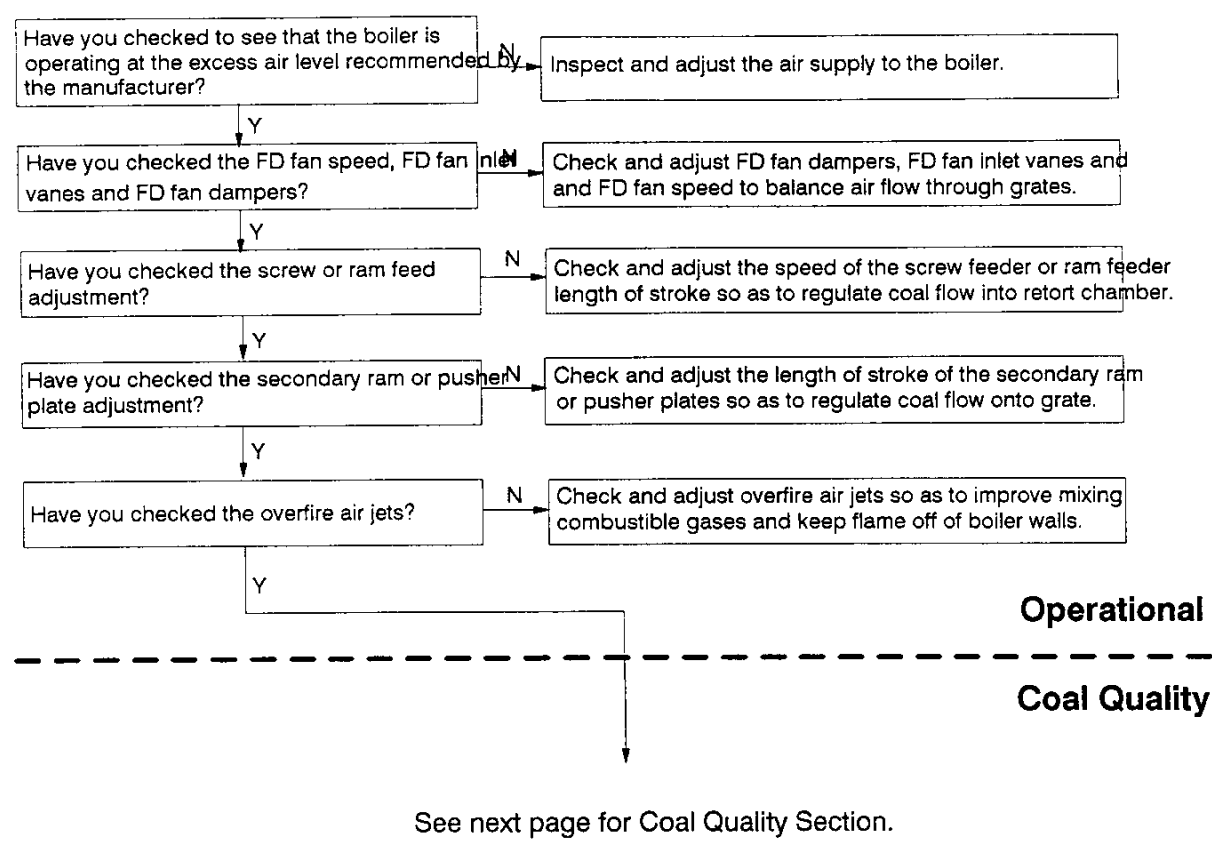
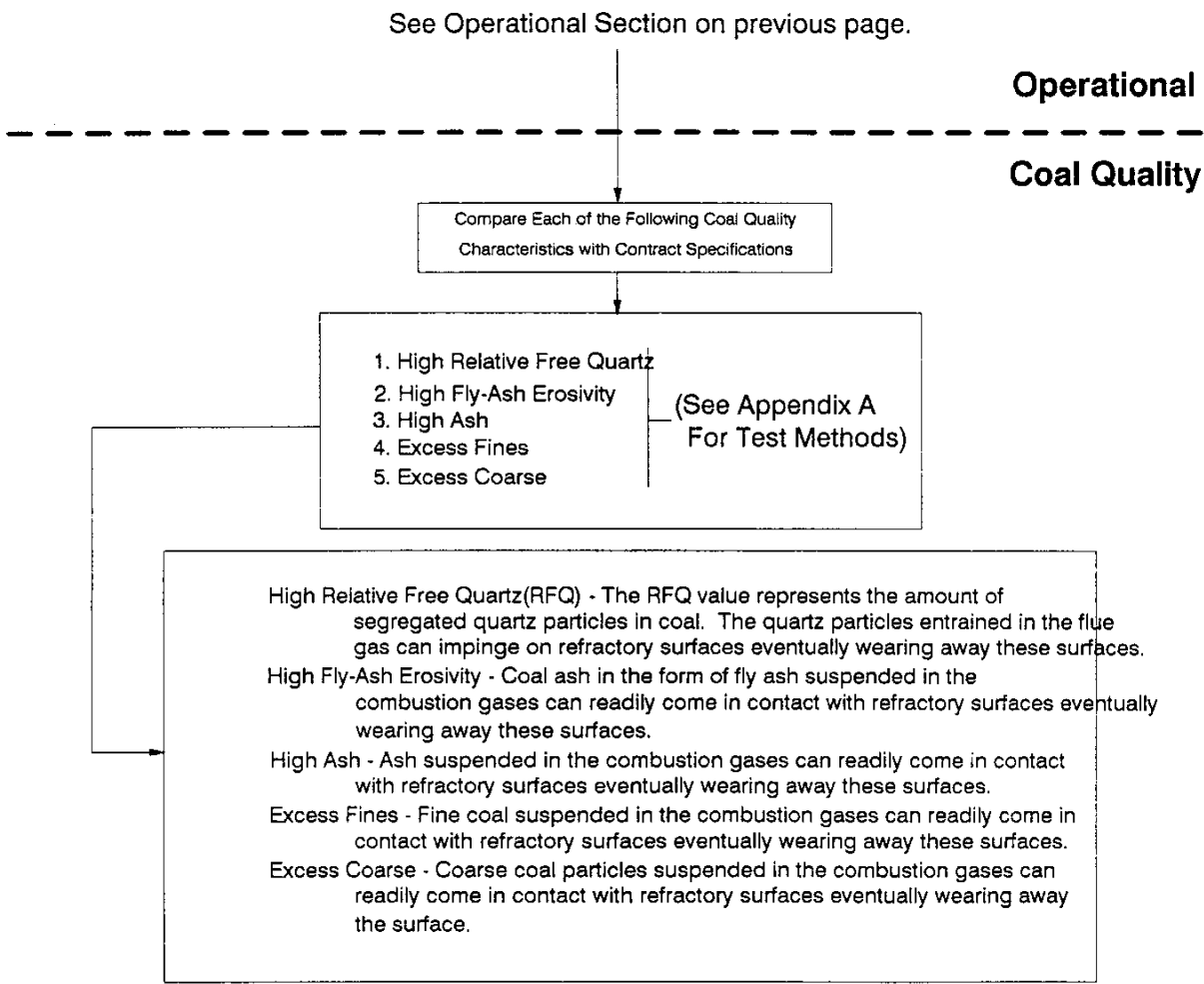


FIGURE 3-66 (continued): UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Erosion Of Heat Transfer Surfaces  
(Refractory Surfaces)





**FIGURE 3-67: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM**  
**For Slagging/Spalling Of Heat Transfer Surfaces**  
**(Refractory Surfaces)**

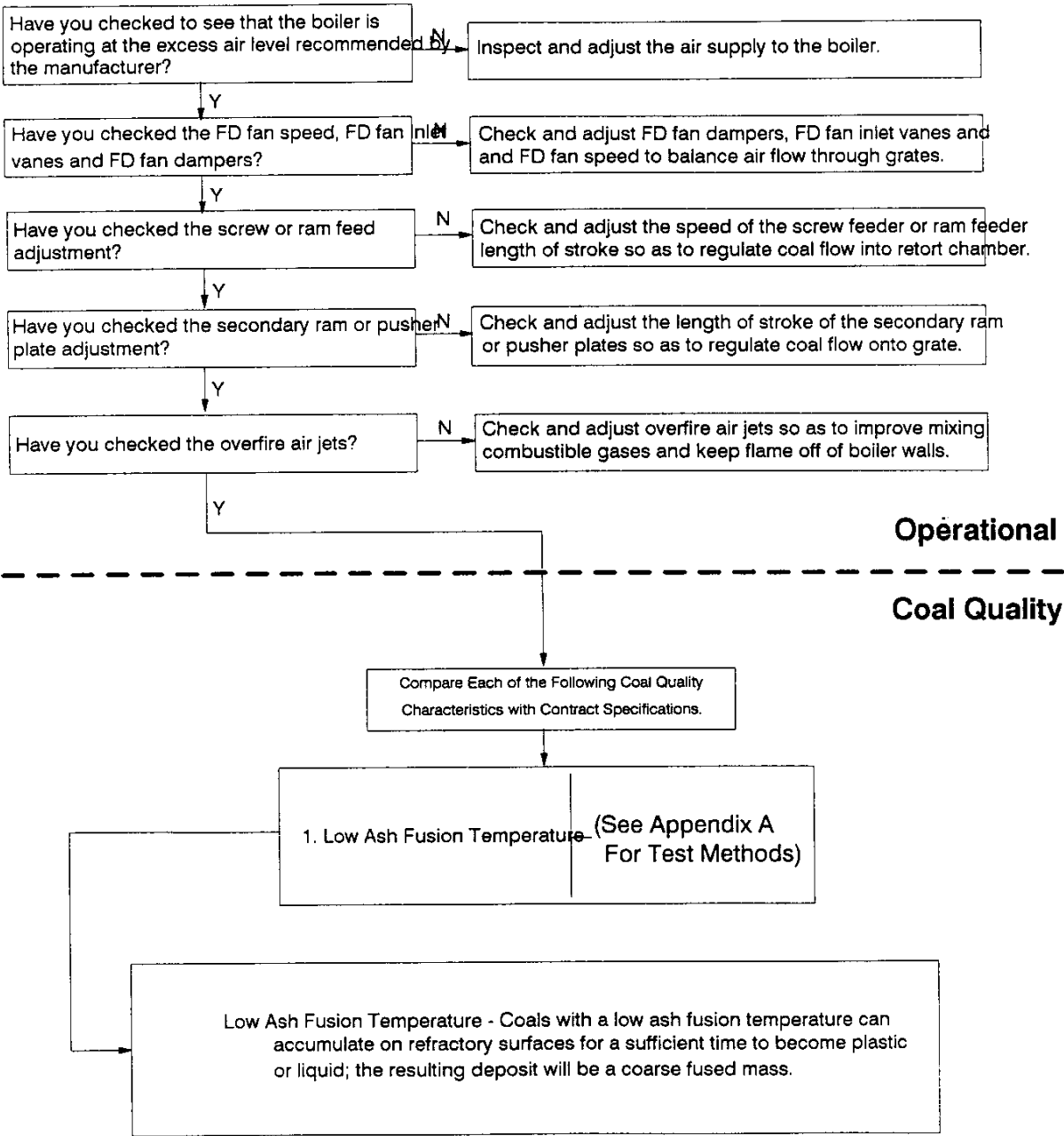


FIG3-67n/2

FIGURE 3-68: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Corrosion Of Heat Transfer Surfaces  
(Boiler Tubes and Water Walls)

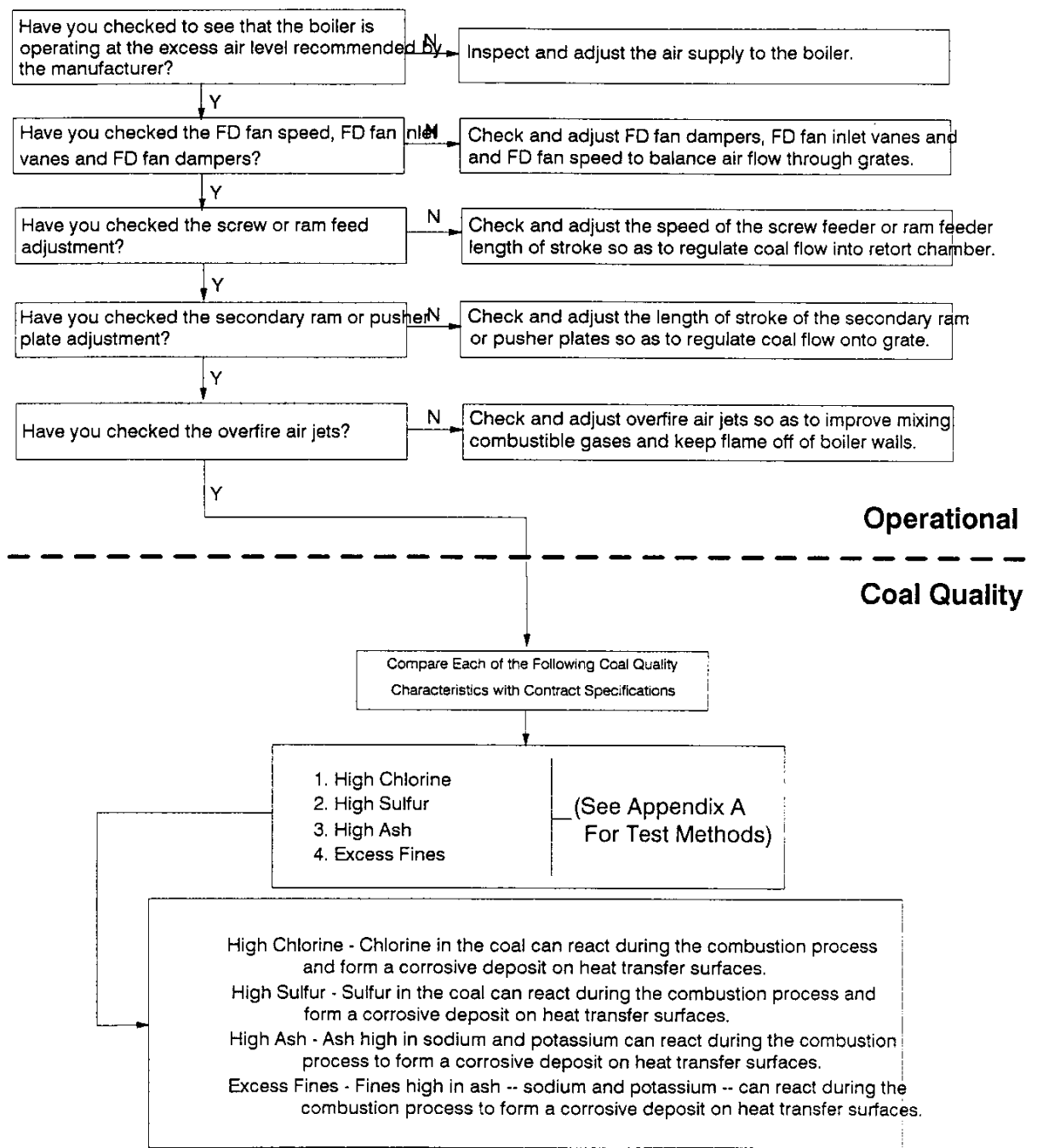


FIGURE 3-69: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Erosion Of Heat Transfer Surfaces  
(Boiler Tubes and Water Walls)

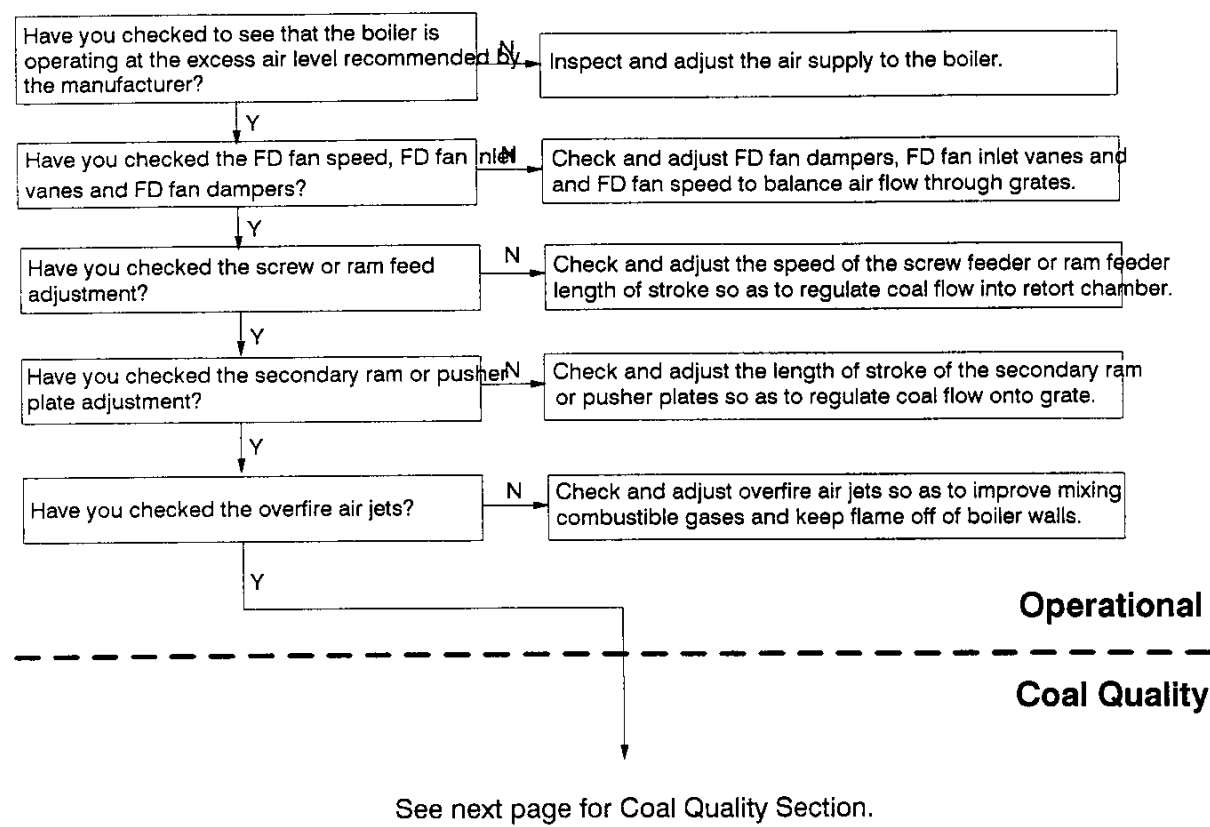


FIGURE 3-69 (continued): UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Erosion Of Heat Transfer Surfaces  
(Boiler Tubes and Water Walls)

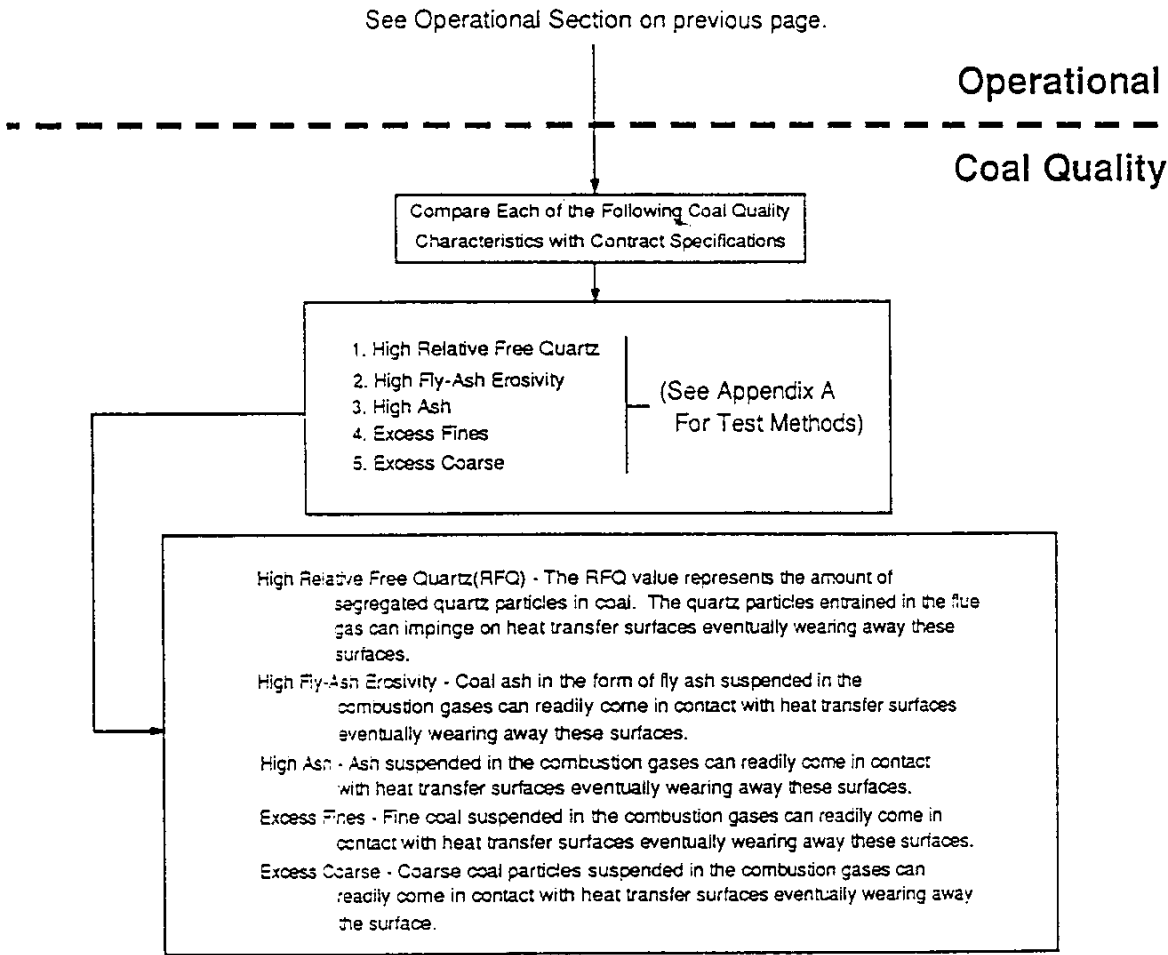


FIGURE 3-70: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Slagging/Spalling Of Heat Transfer Surfaces  
(Boiler Tubes and Water Walls)

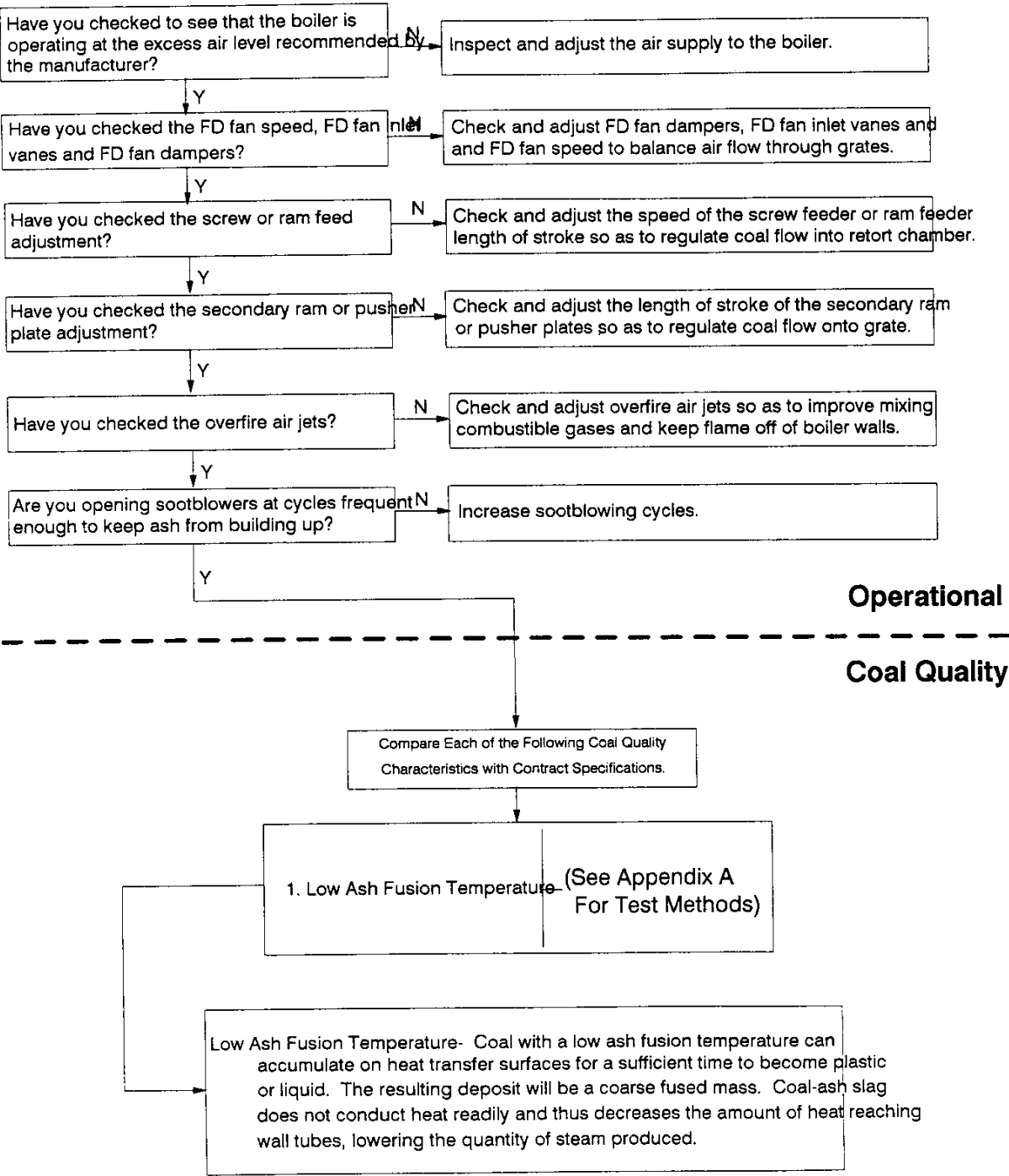


FIG3-70n/2

FIGURE 3-71: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Fouling Of Heat Transfer Surfaces  
(Boiler Tubes and Water Walls)

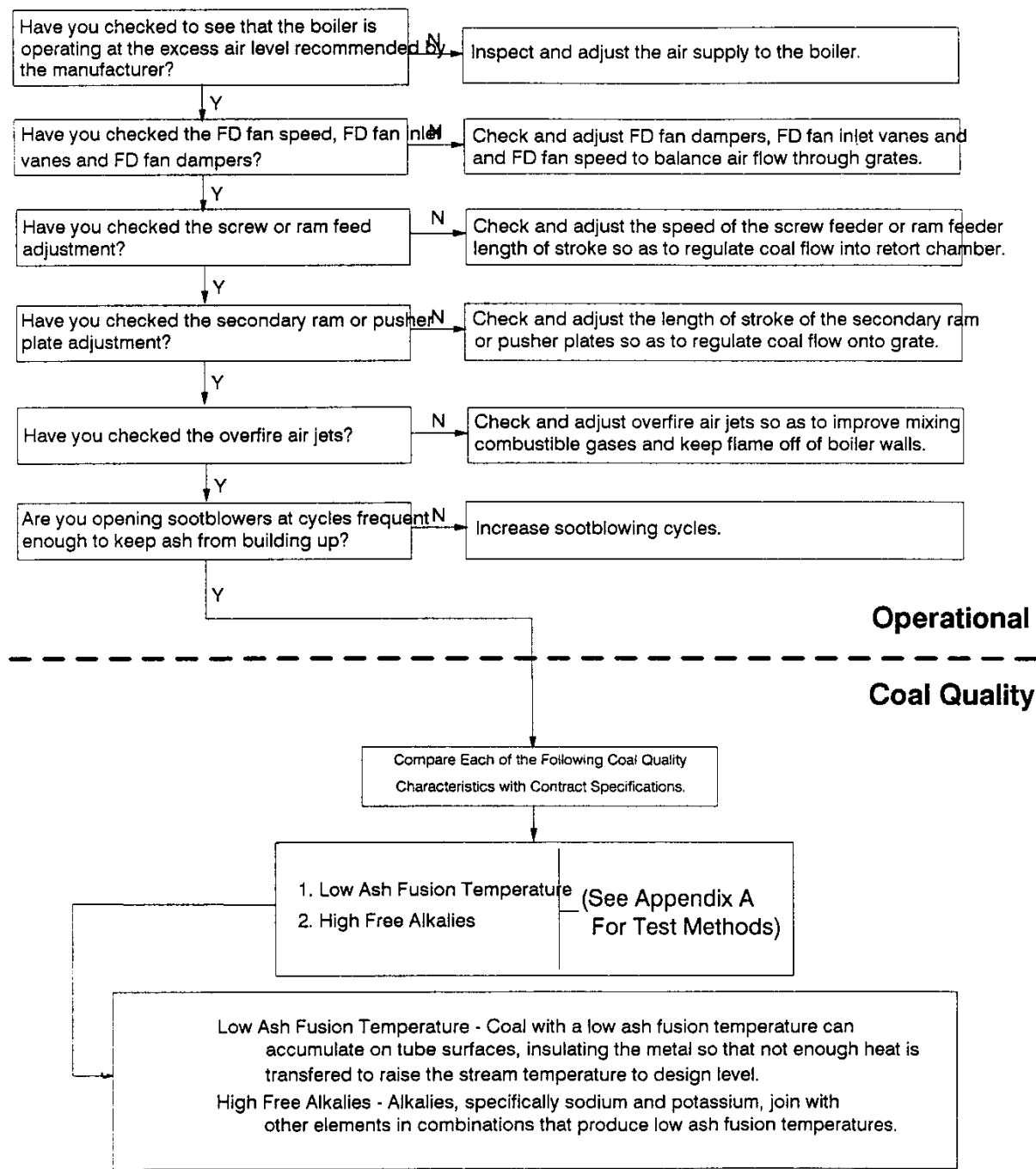


FIGURE 3-72: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Corrosion Of Heat Transfer Surfaces  
(Baffles)

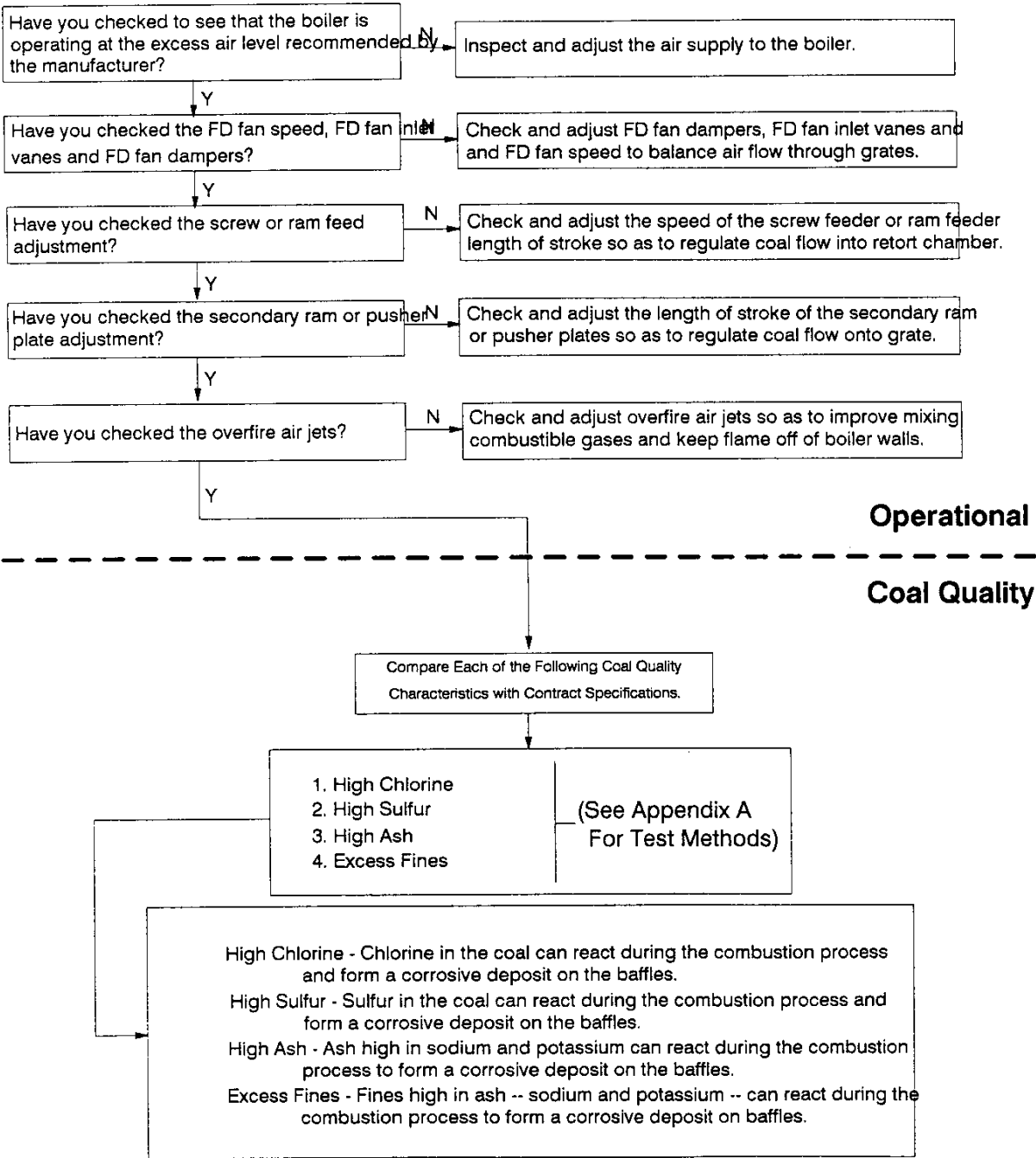


FIG3-72n/3

**FIGURE 3-73: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Erosion Of Heat Transfer Surfaces  
(Baffles)**

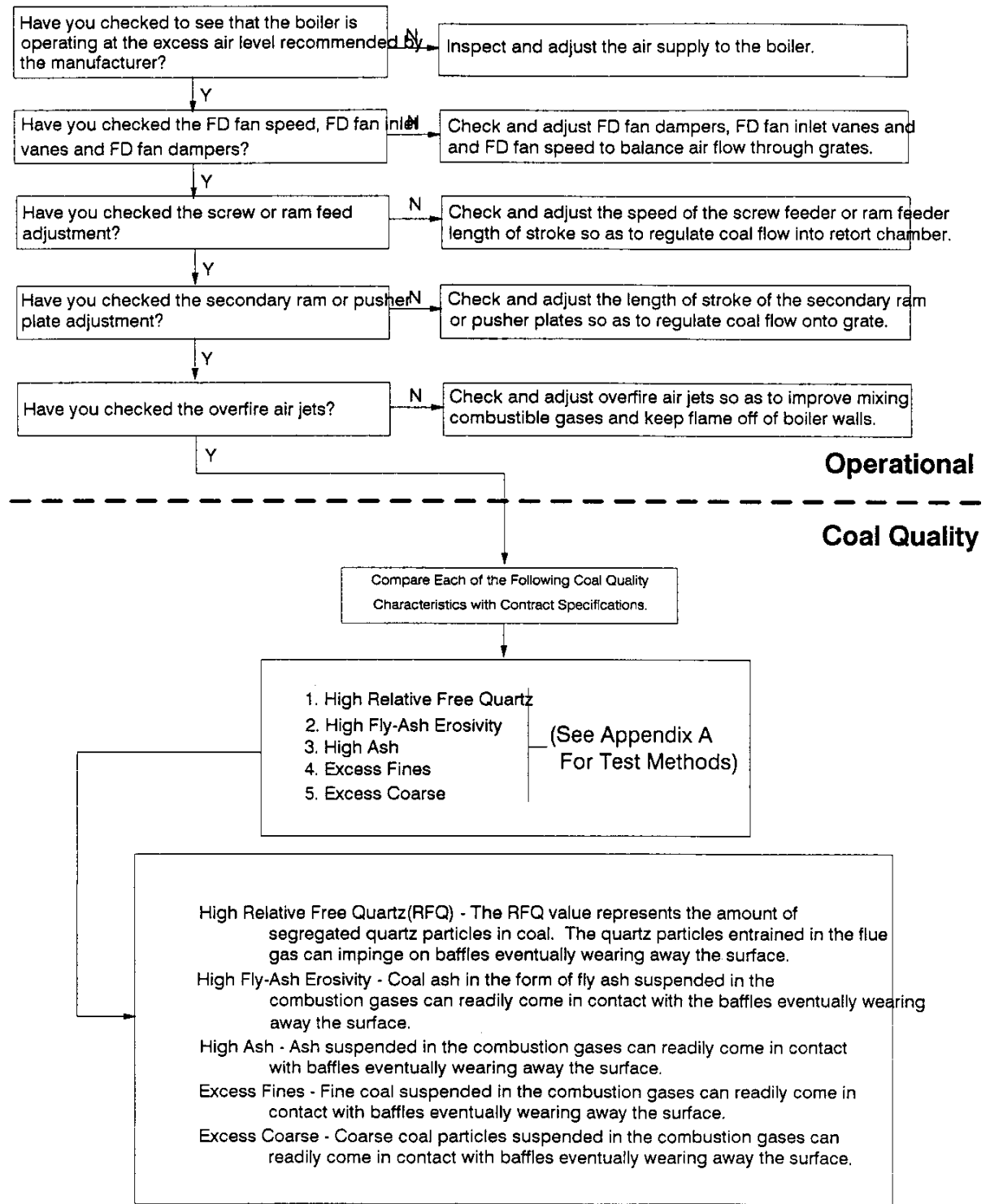


FIG3-73n/3



FIGURE 3-74: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Slagging/Spalling Of Heat Transfer Surfaces  
(Baffles)

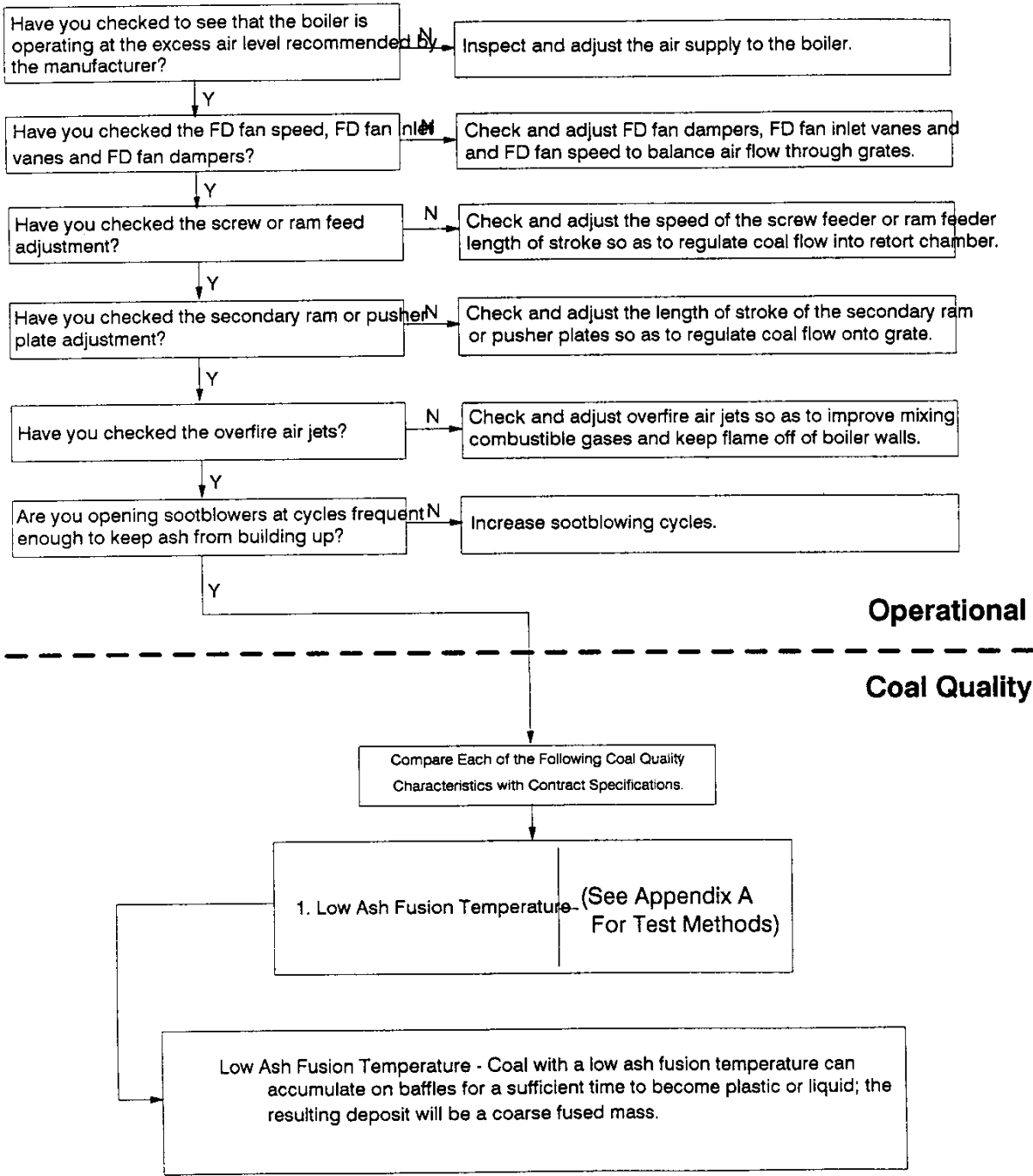


FIG3-74n/3

**FIGURE 3-75: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM**  
**For Fouling Of Heat Transfer Surfaces**  
**(Baffles)**

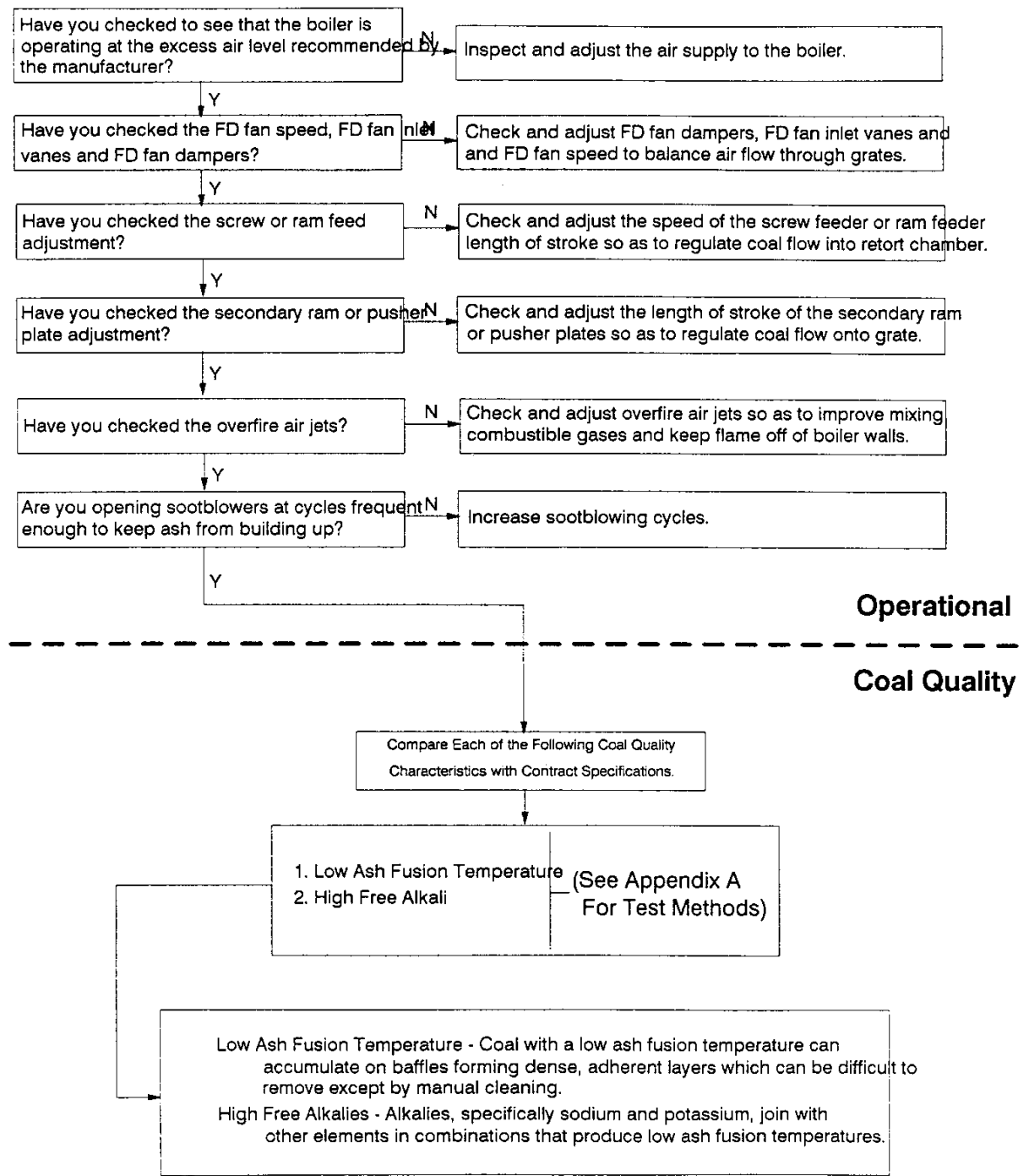


FIG3-75n/3

FIGURE 3-76: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Insufficient Capacity and Inability To Meet Load  
(Forced Draft Fan)

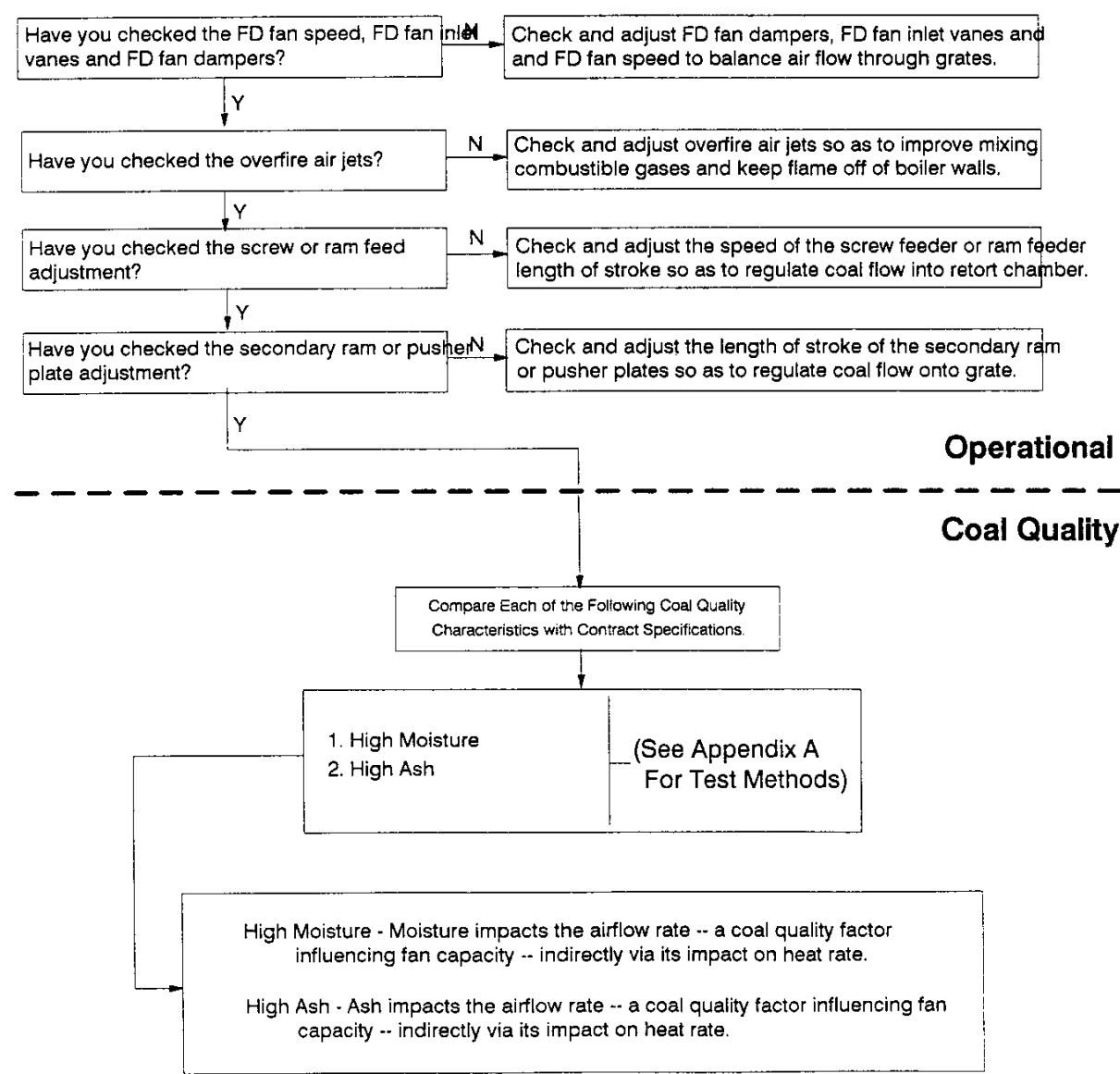


FIG3-76n/3

FIGURE 3-77: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Smoking Around The Forced Draft Fan

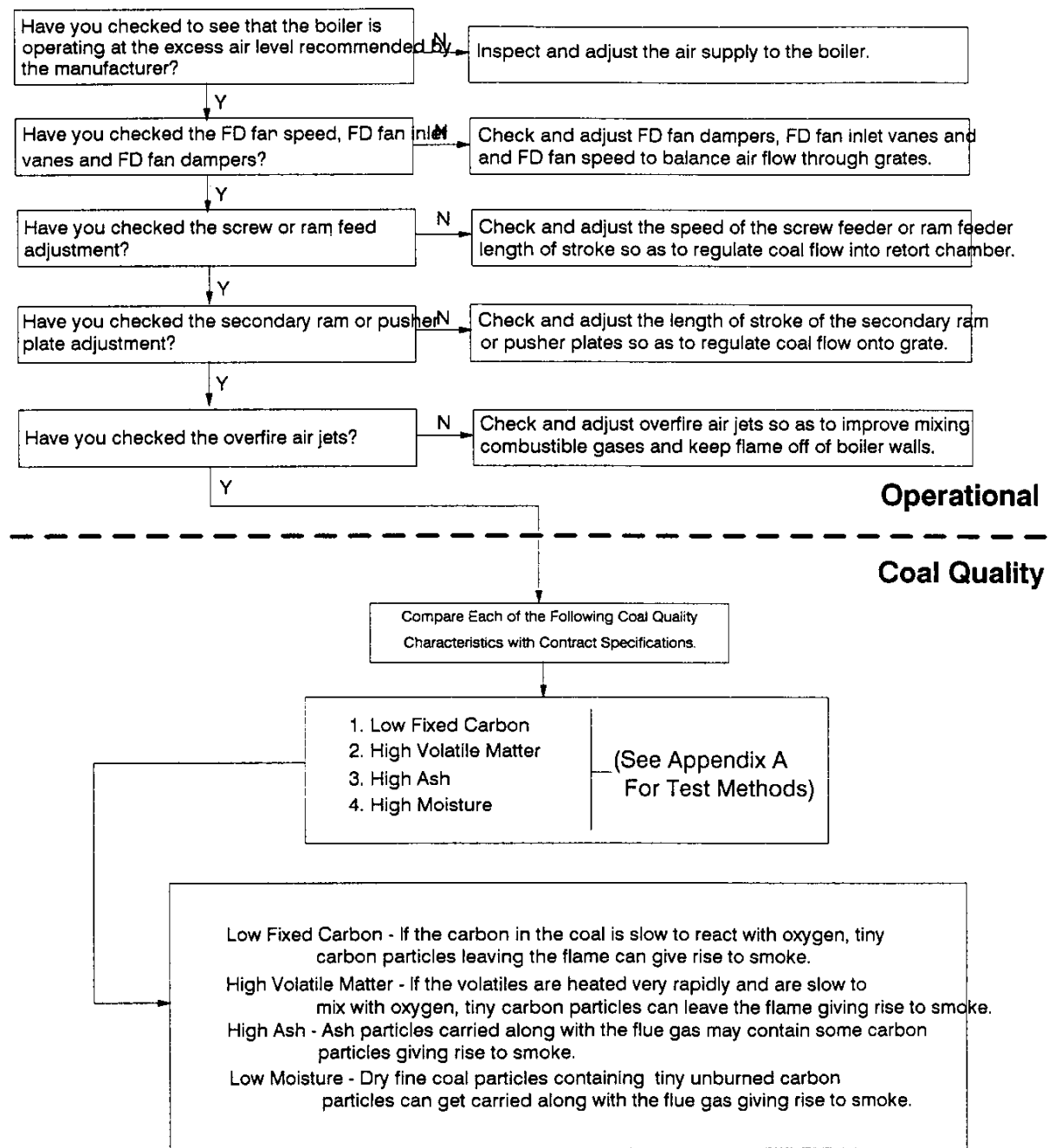


FIG3-77n/3

**FIGURE 3-78: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM**  
**For Insufficient Capacity And Inability To Meet Load**  
**(Induced Draft Fan)**

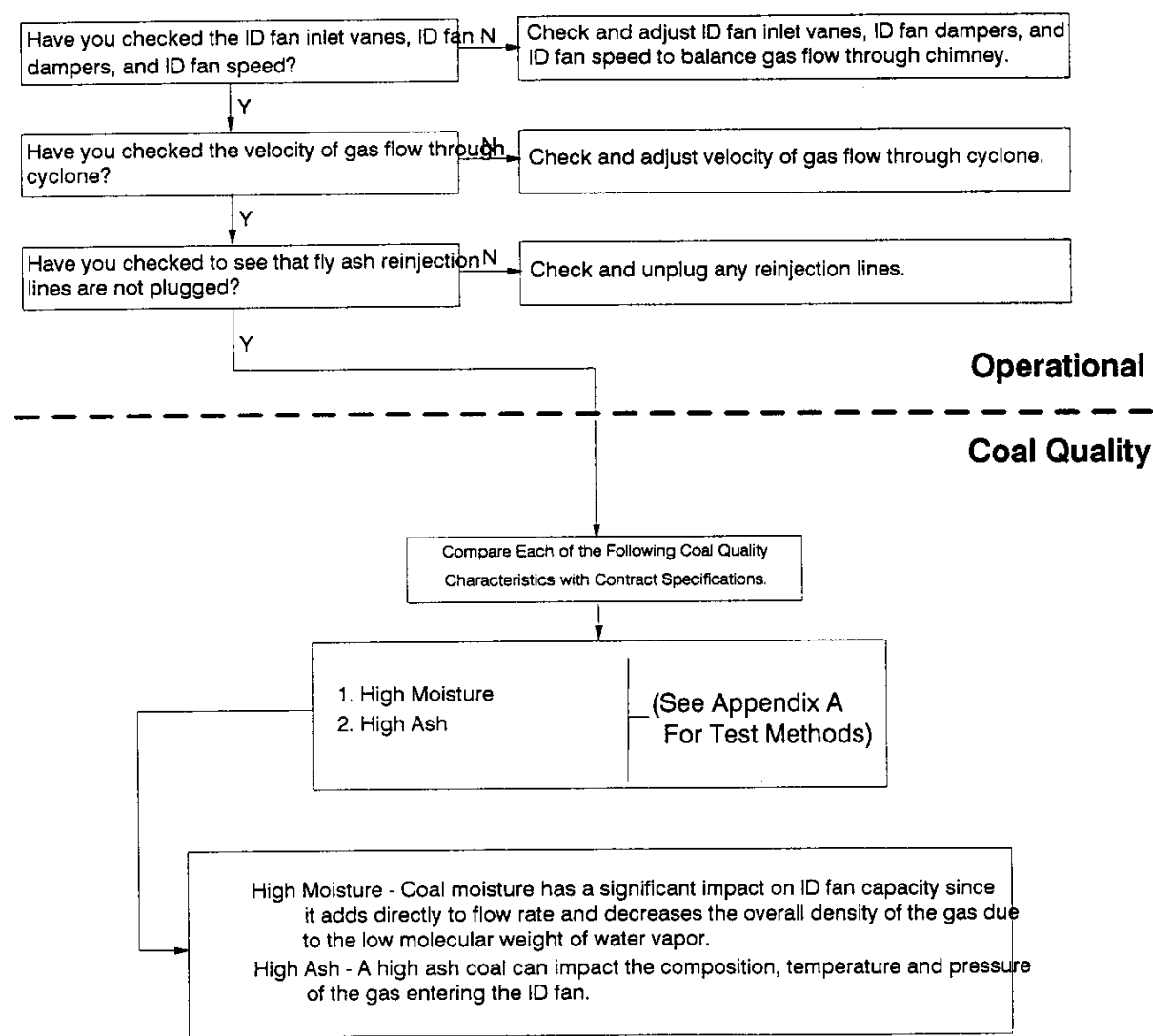


FIGURE 3-79: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Corrosion Of The Induced Draft Fan

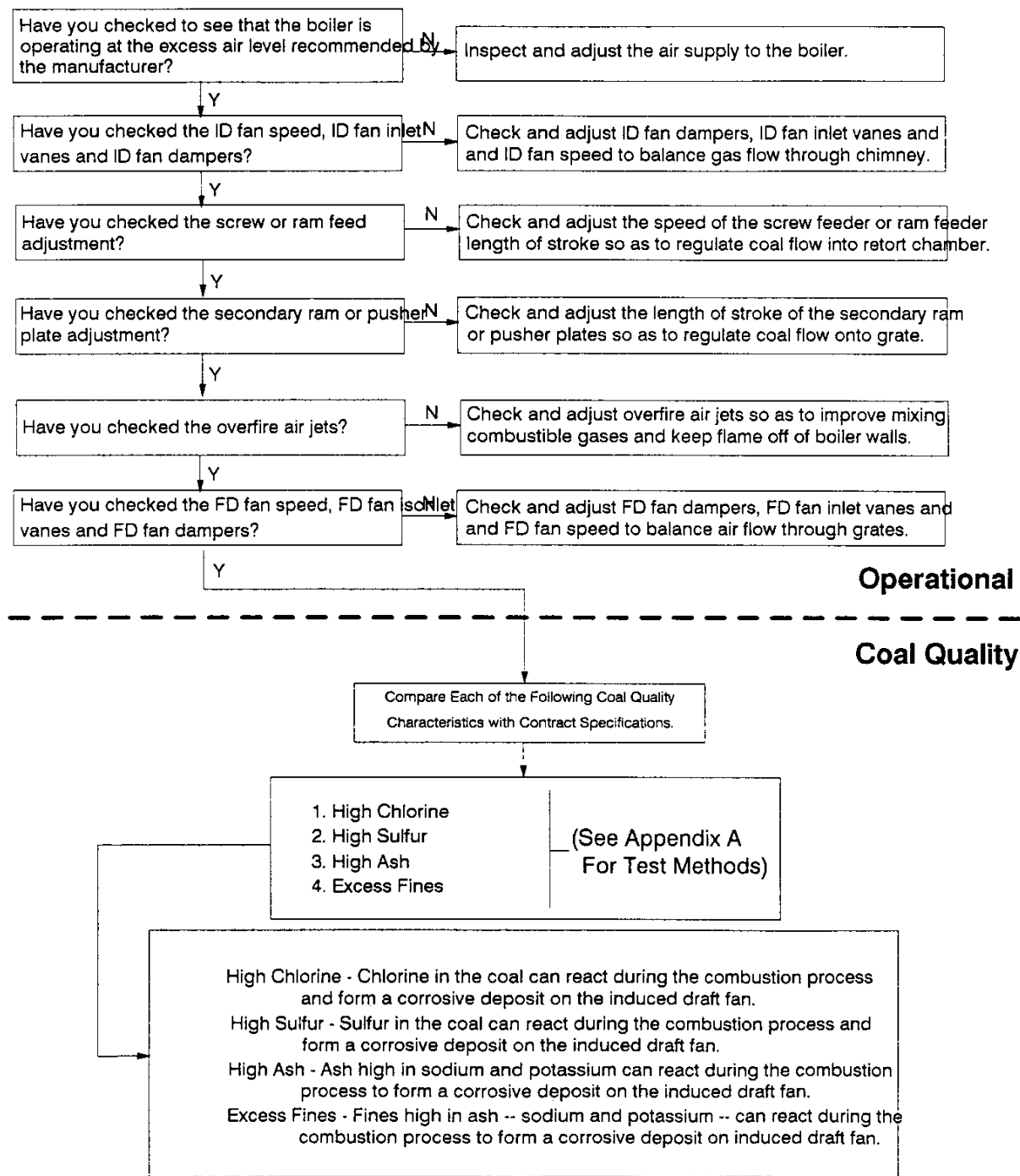


FIG3-77n/3

FIGURE 3-80: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Smoking From The Induced Draft Fan

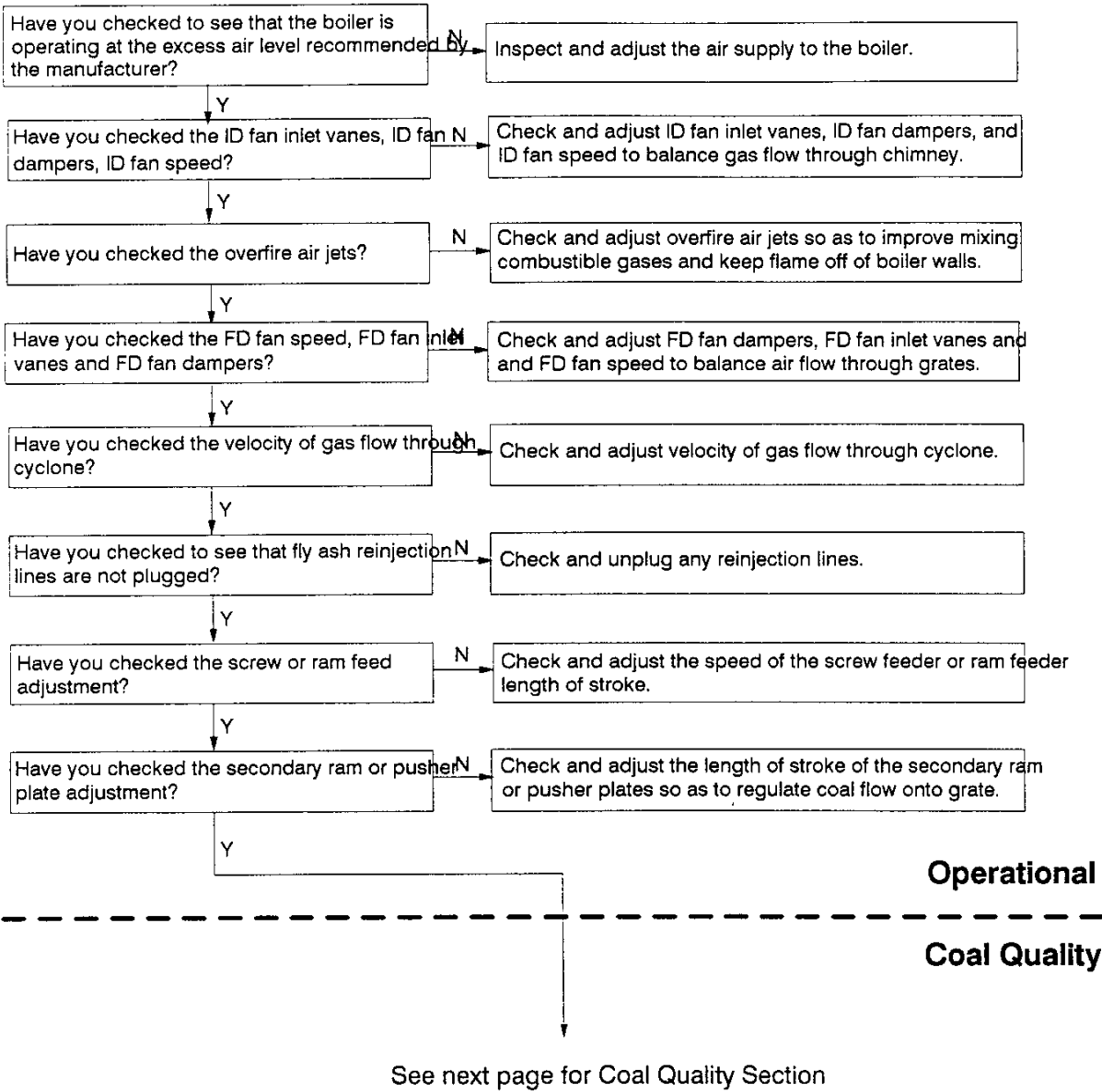


FIGURE 3-80 (continued): UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Smoking From The Induced Draft Fan

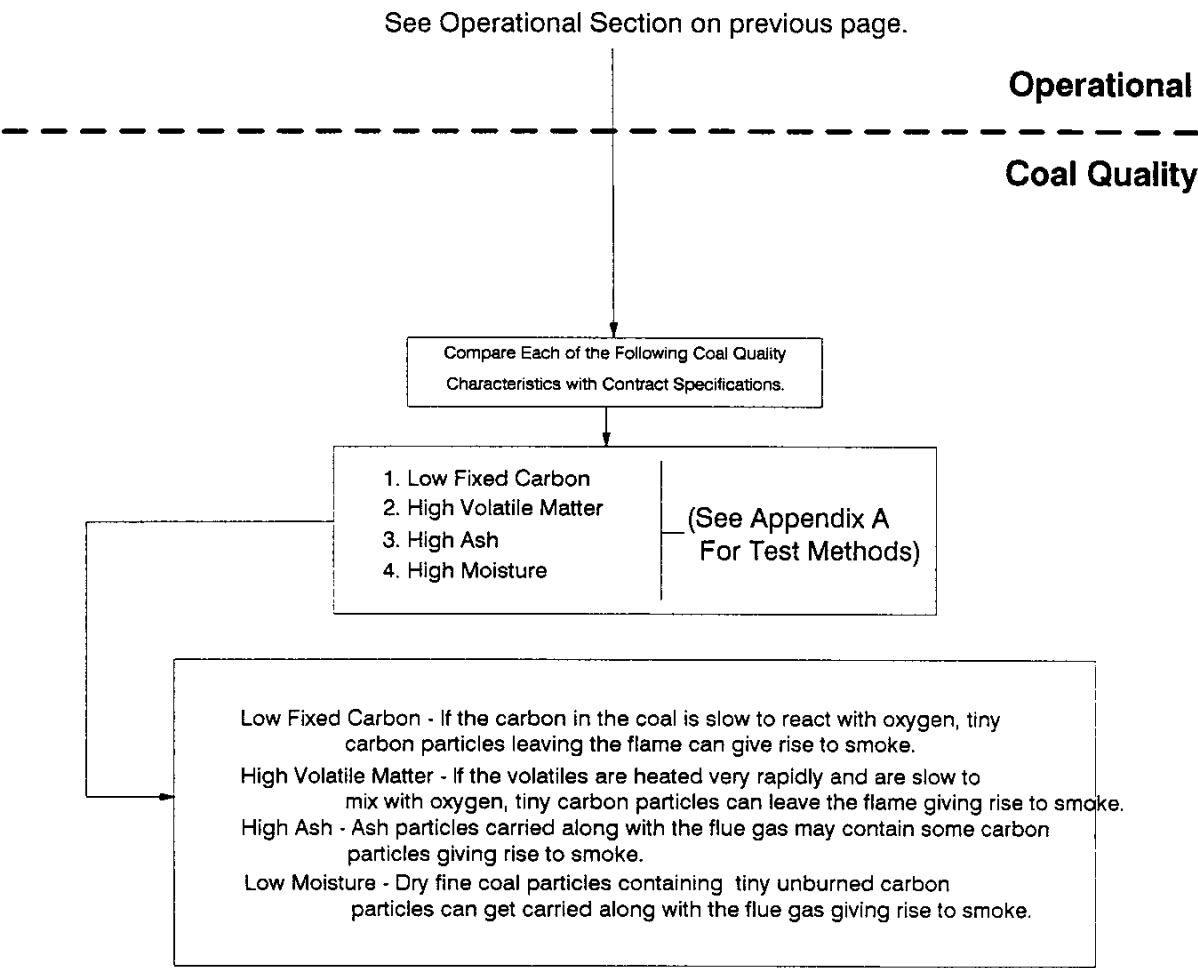




FIGURE 3-81: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Erosion Of The Induced Draft Fan

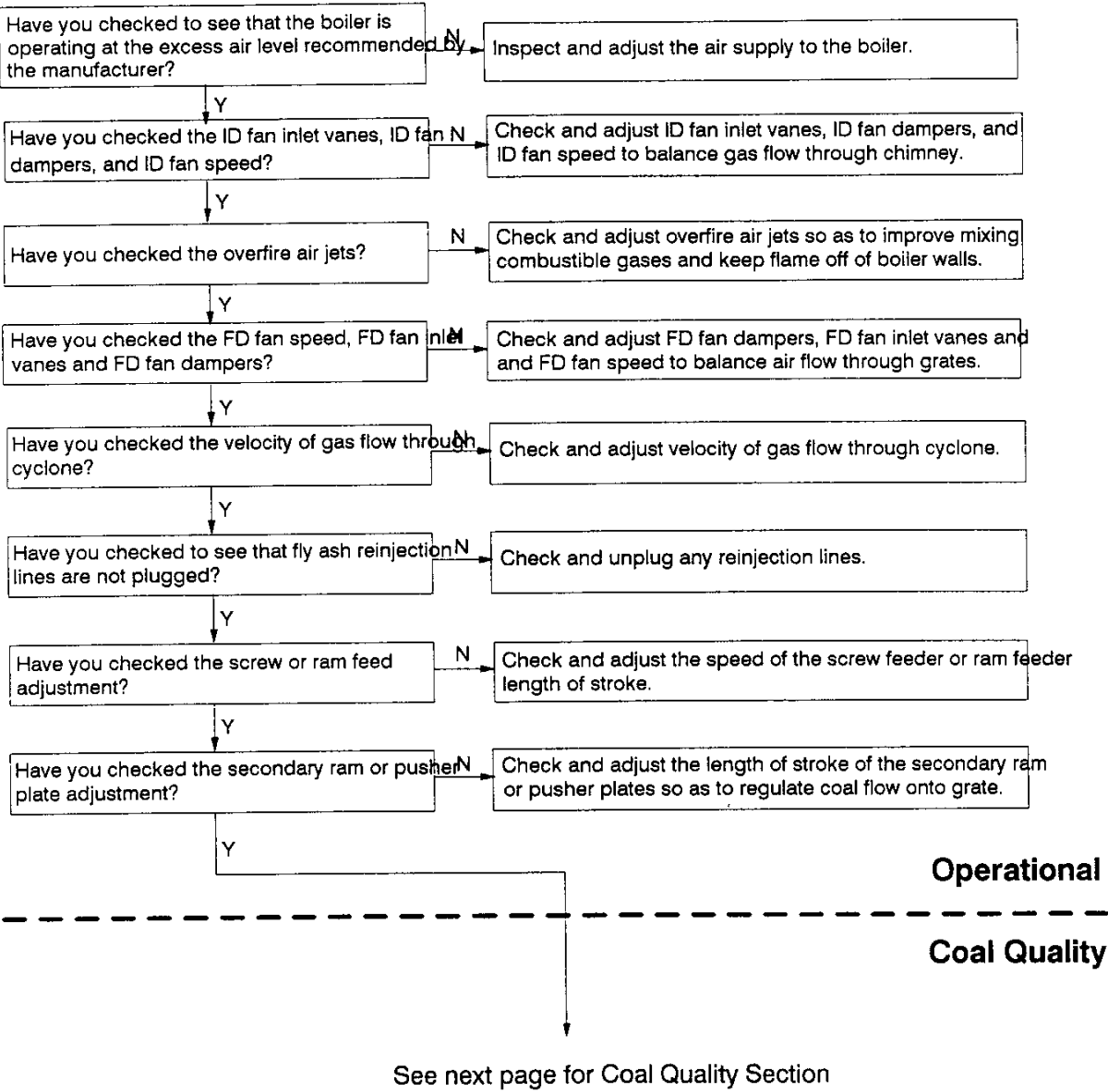


FIGURE 3-81 (continued): UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Erosion Of The Induced Draft Fan

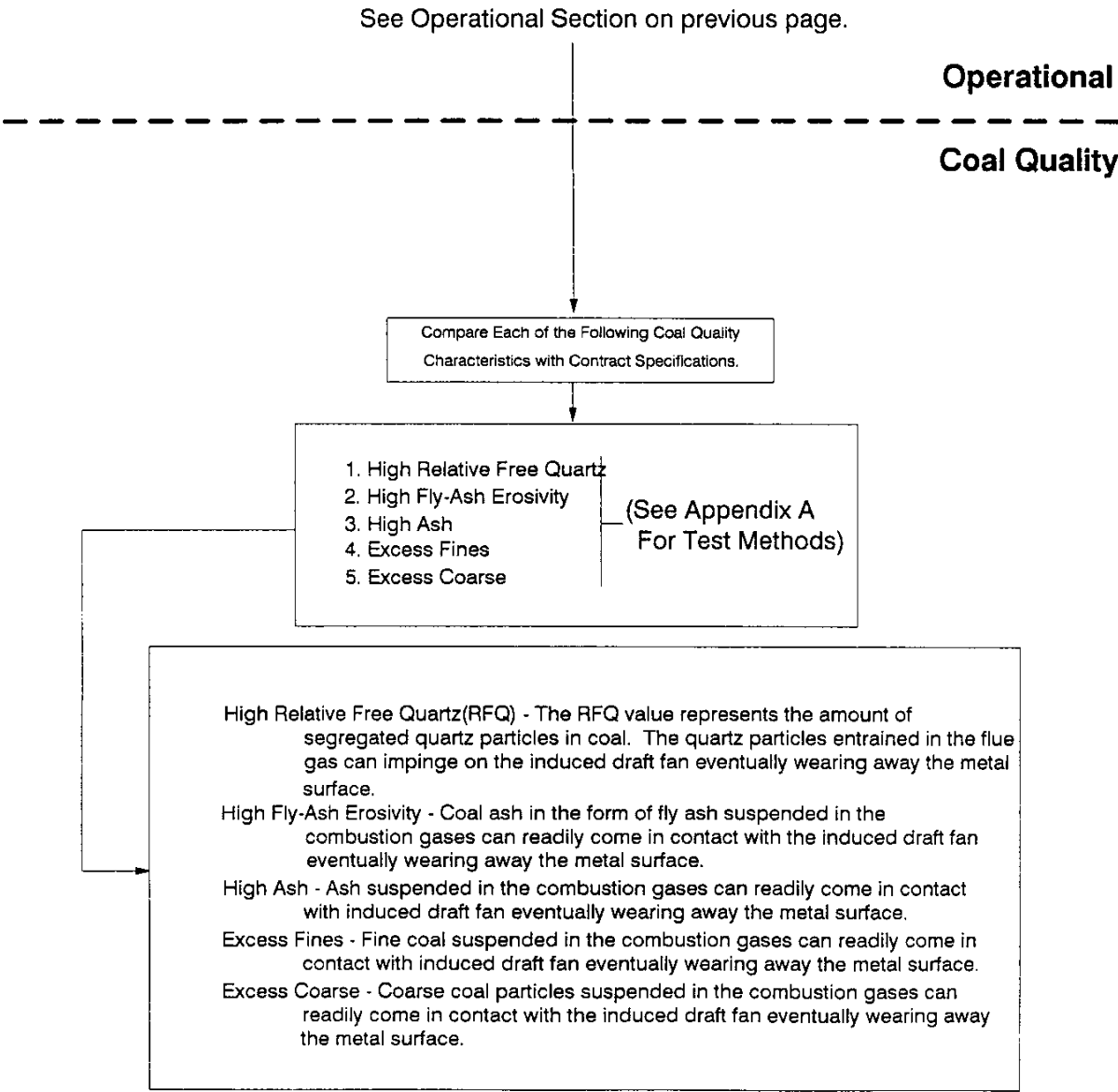
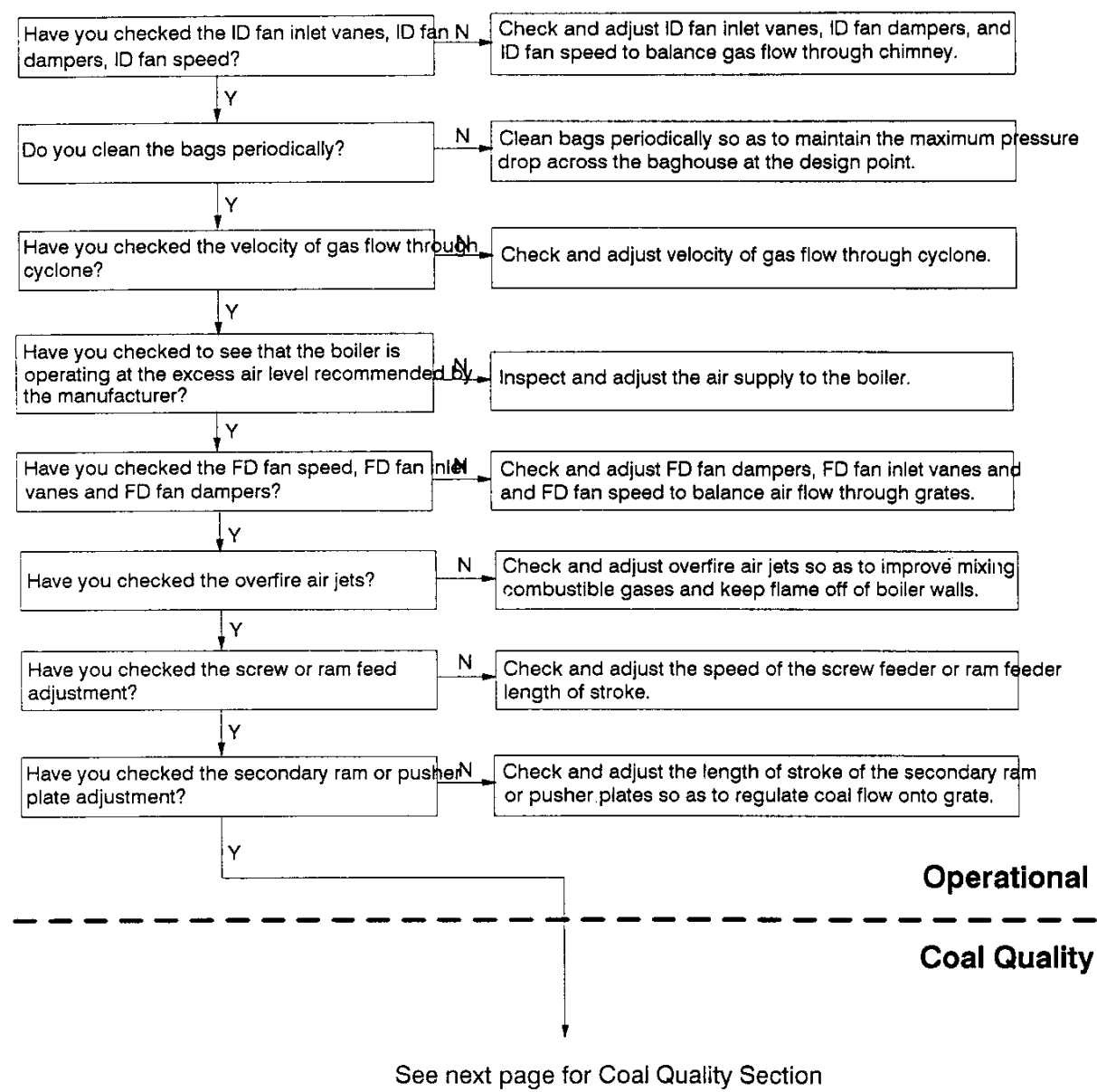


FIGURE 3-82: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Carbon Burnout From The Particulate Removal System  
(Baghouse)



**FIGURE 3-82 (continued): UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM**  
**For Carbon Burnout From The Particulate Removal System**  
**(Baghouse)**

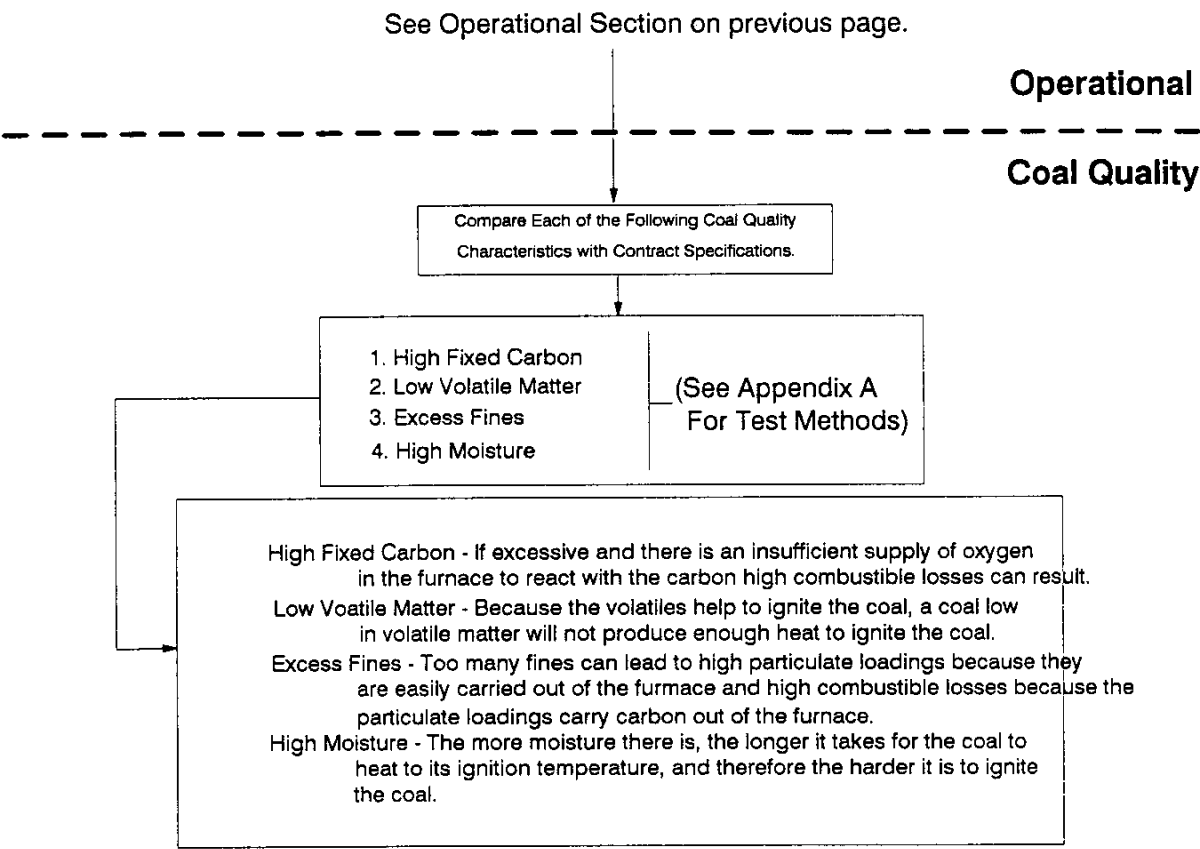


FIGURE 3-83: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Excess Particulate Emissions From The Particulate Removal System  
(Baghouse)

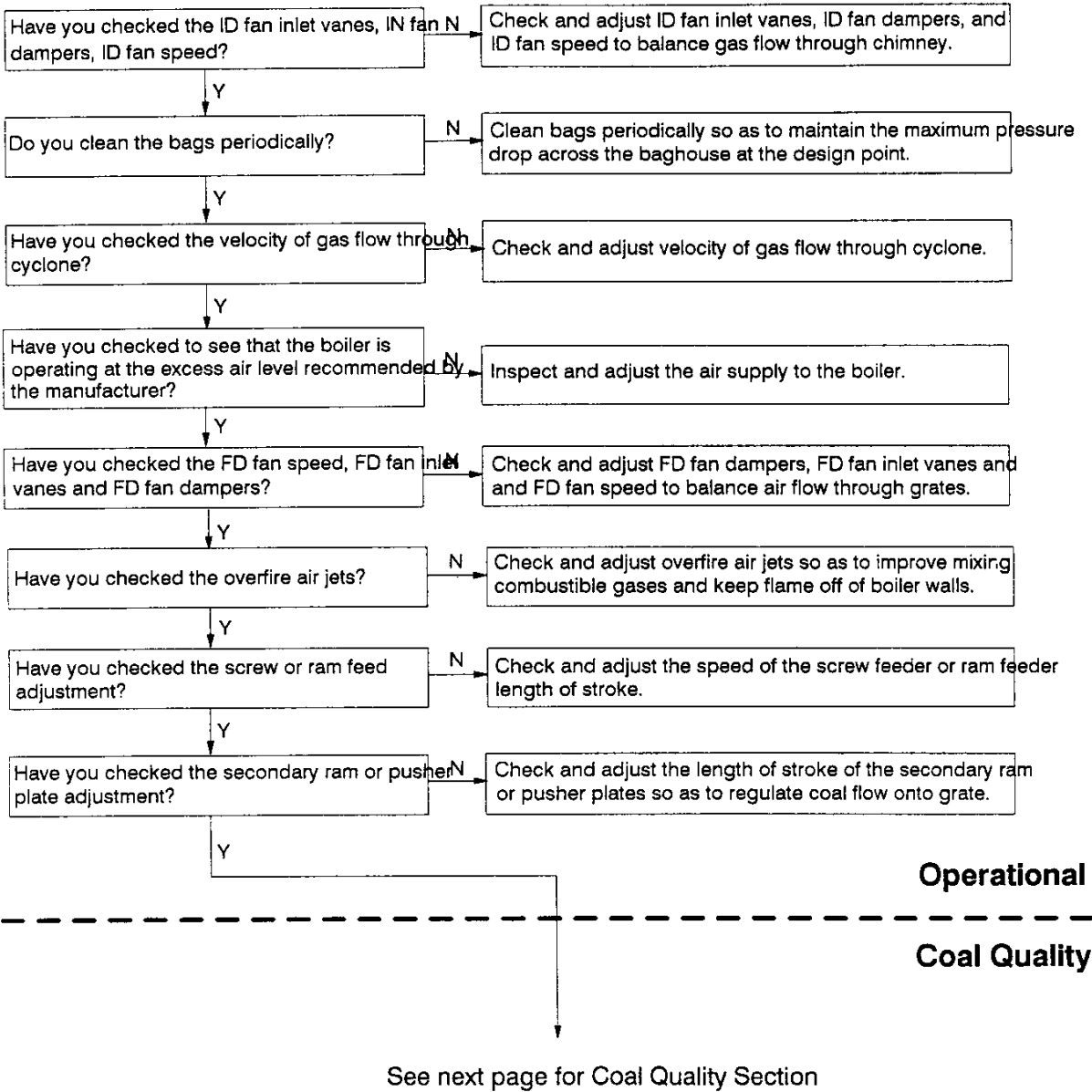
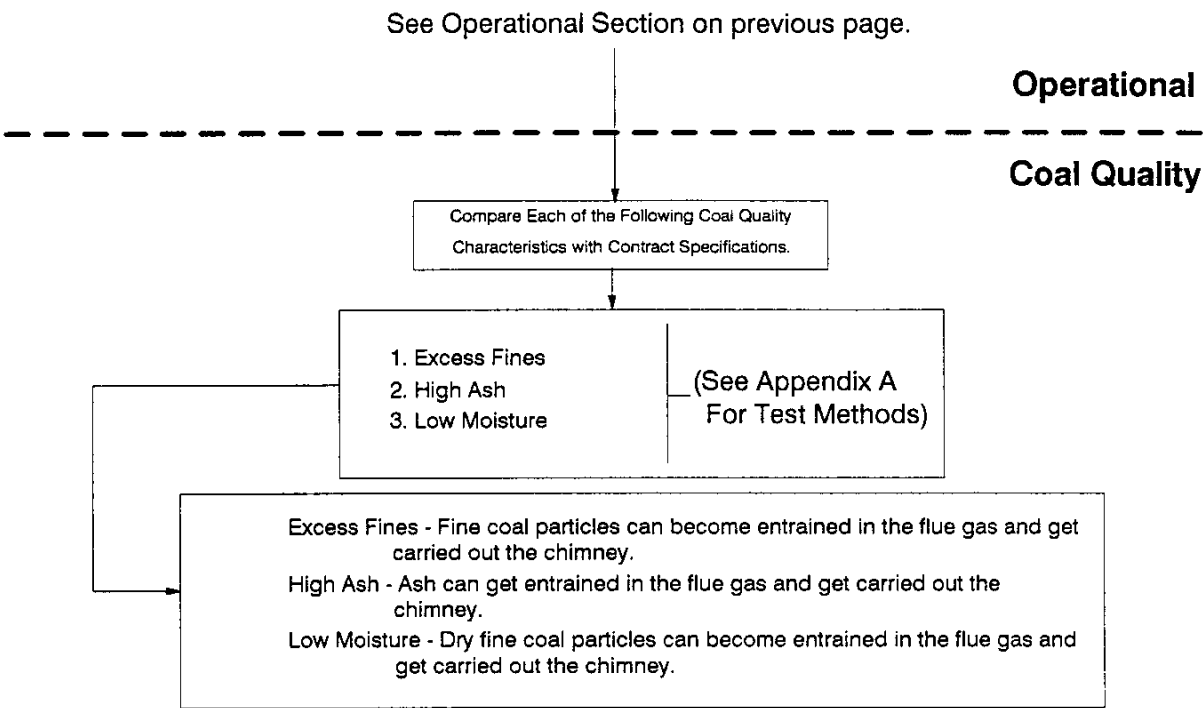
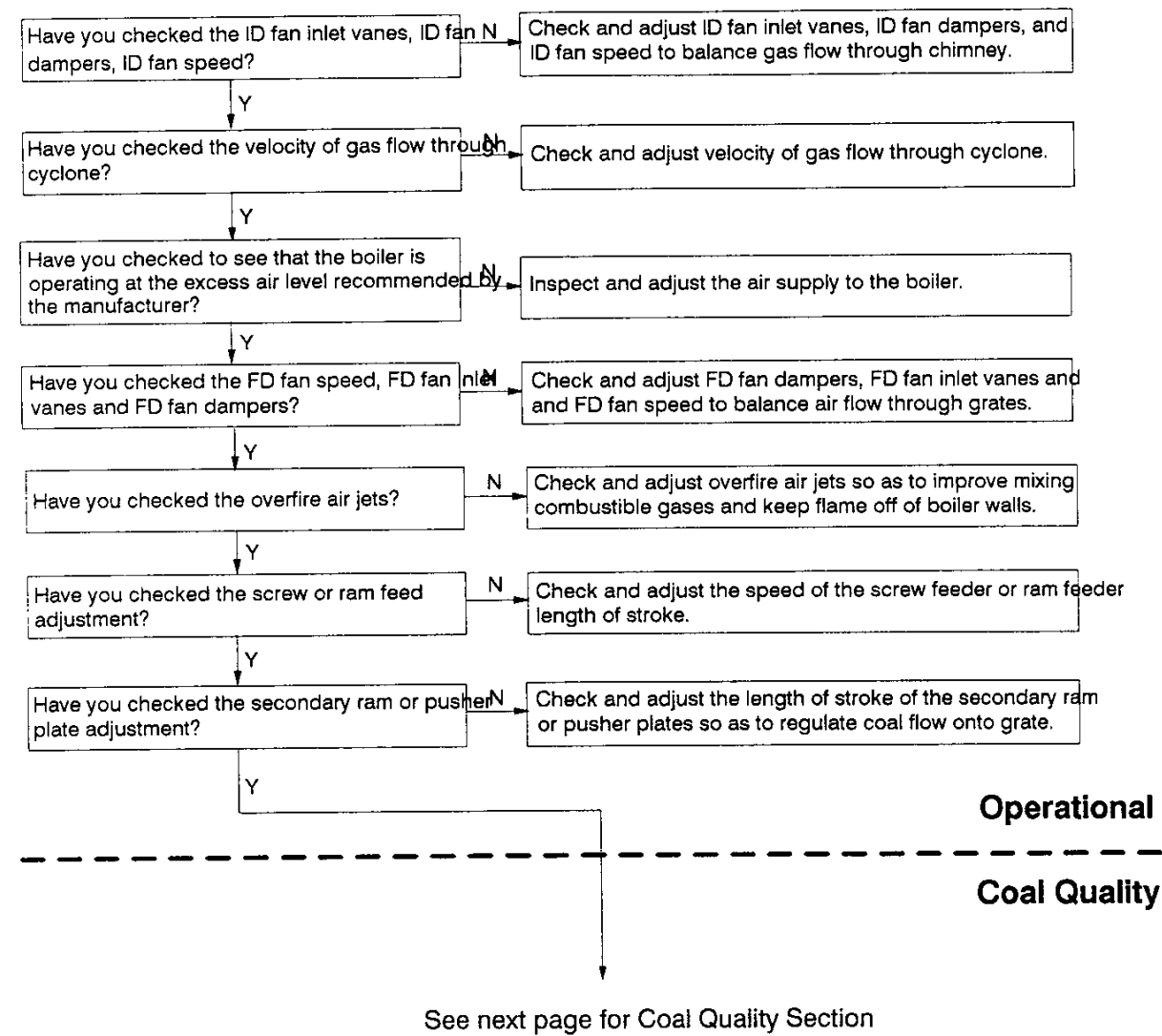


FIG3-83rv3

**FIGURE 3-83 (continued): UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Excess Particulate Emissions From The Particulate Removal System  
(Baghouse)**



**FIGURE 3-84: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM**  
**For Carbon Burnout From The Particulate Removal System**  
**(Cyclone)**



**FIGURE 3-84 (continued): UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGF**  
**For Carbon Burnout From The Particulate Removal System**  
**(Cyclone)**

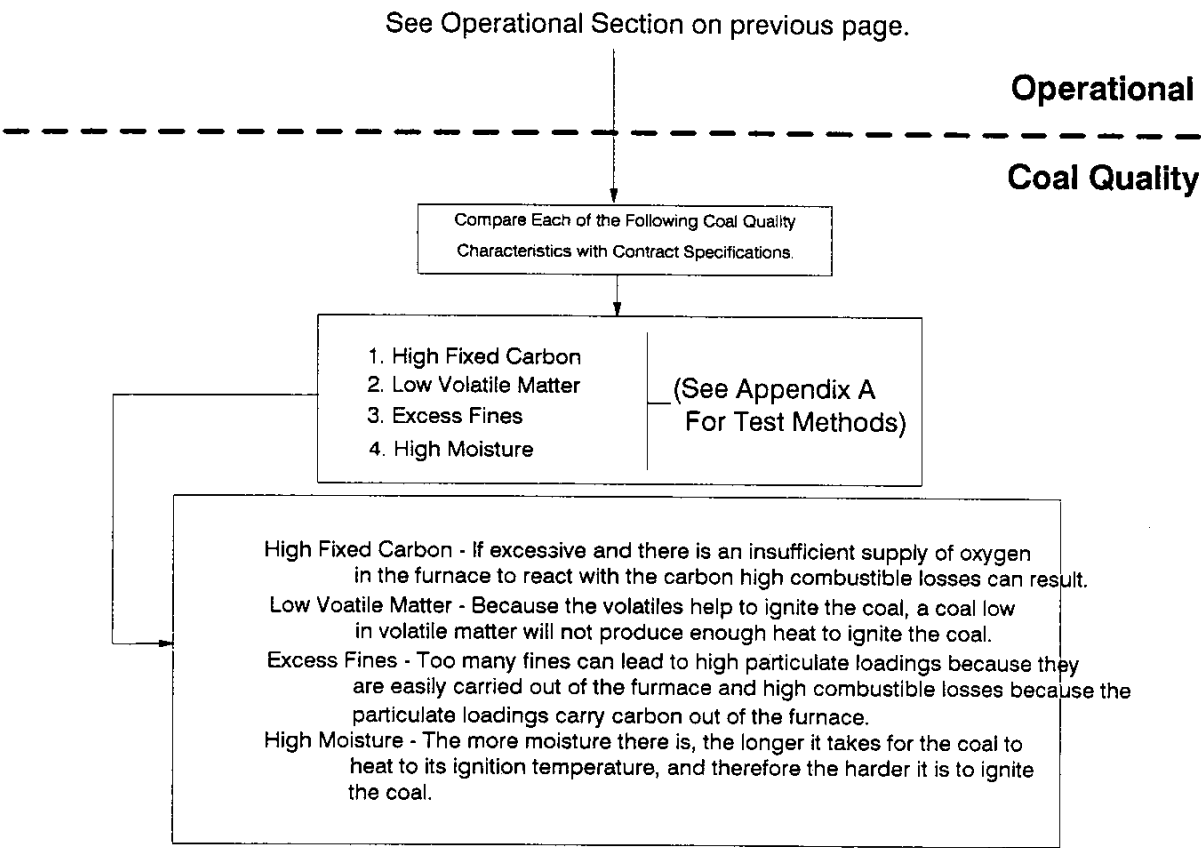




FIGURE 3-85: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Erosion In The Particulate Removal System  
(Cyclone)

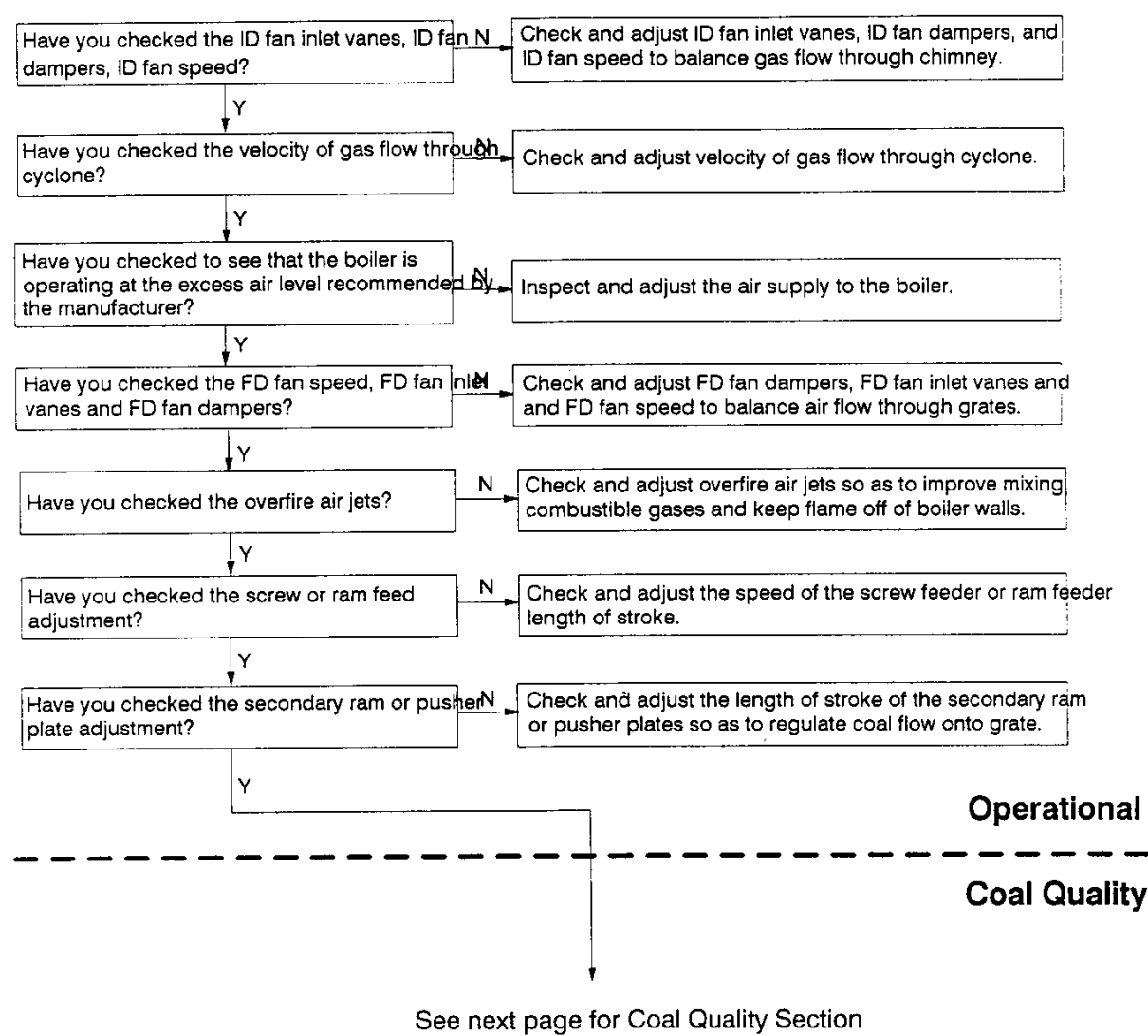


FIG3-85n/3

**FIGURE 3-85 (continued): UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Erosion In The Particulate Removal System  
(Cyclone)**

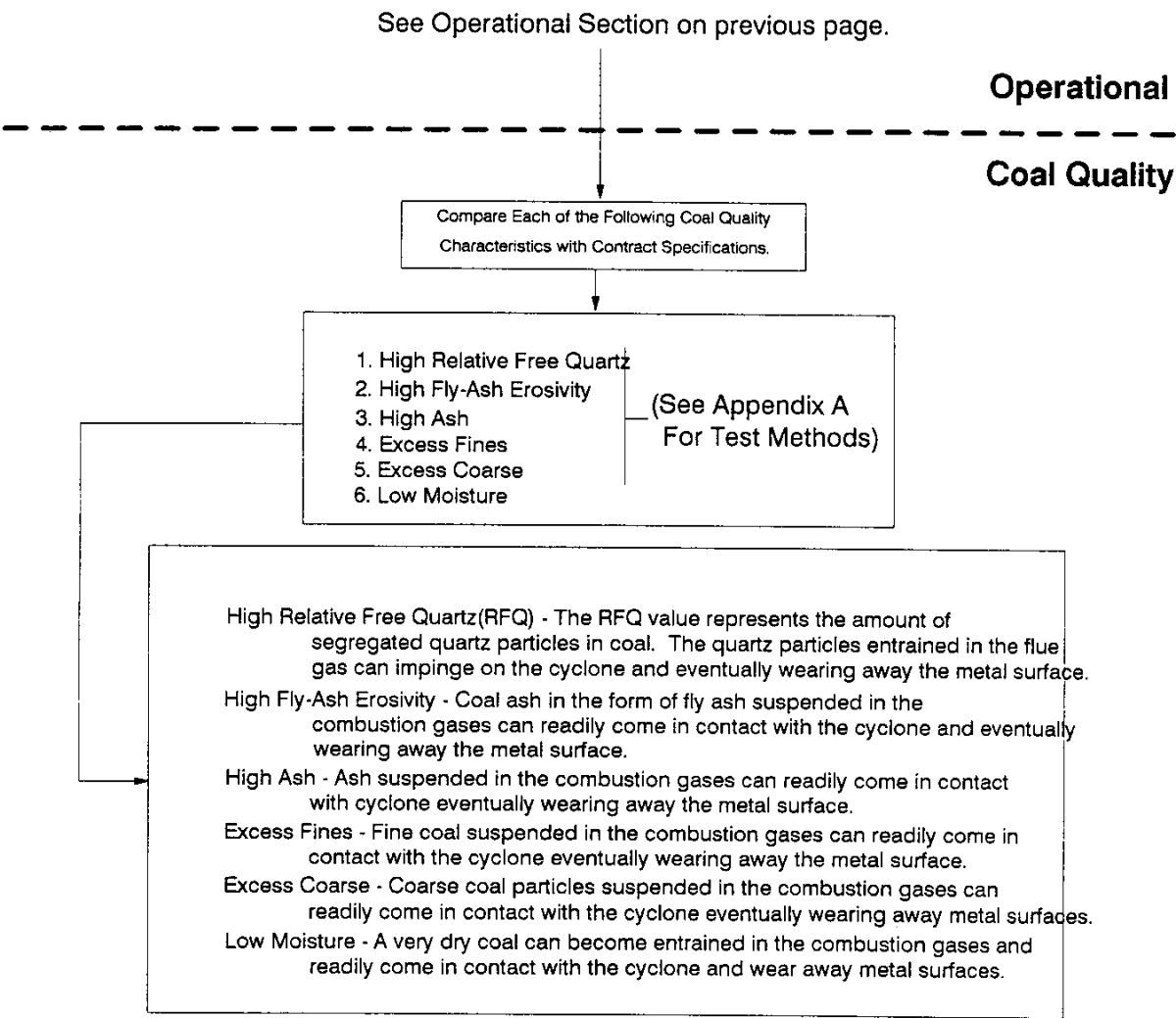


FIGURE 3-86: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Excess Particulate Emissions From The Particulate Removal System  
(Cyclone)

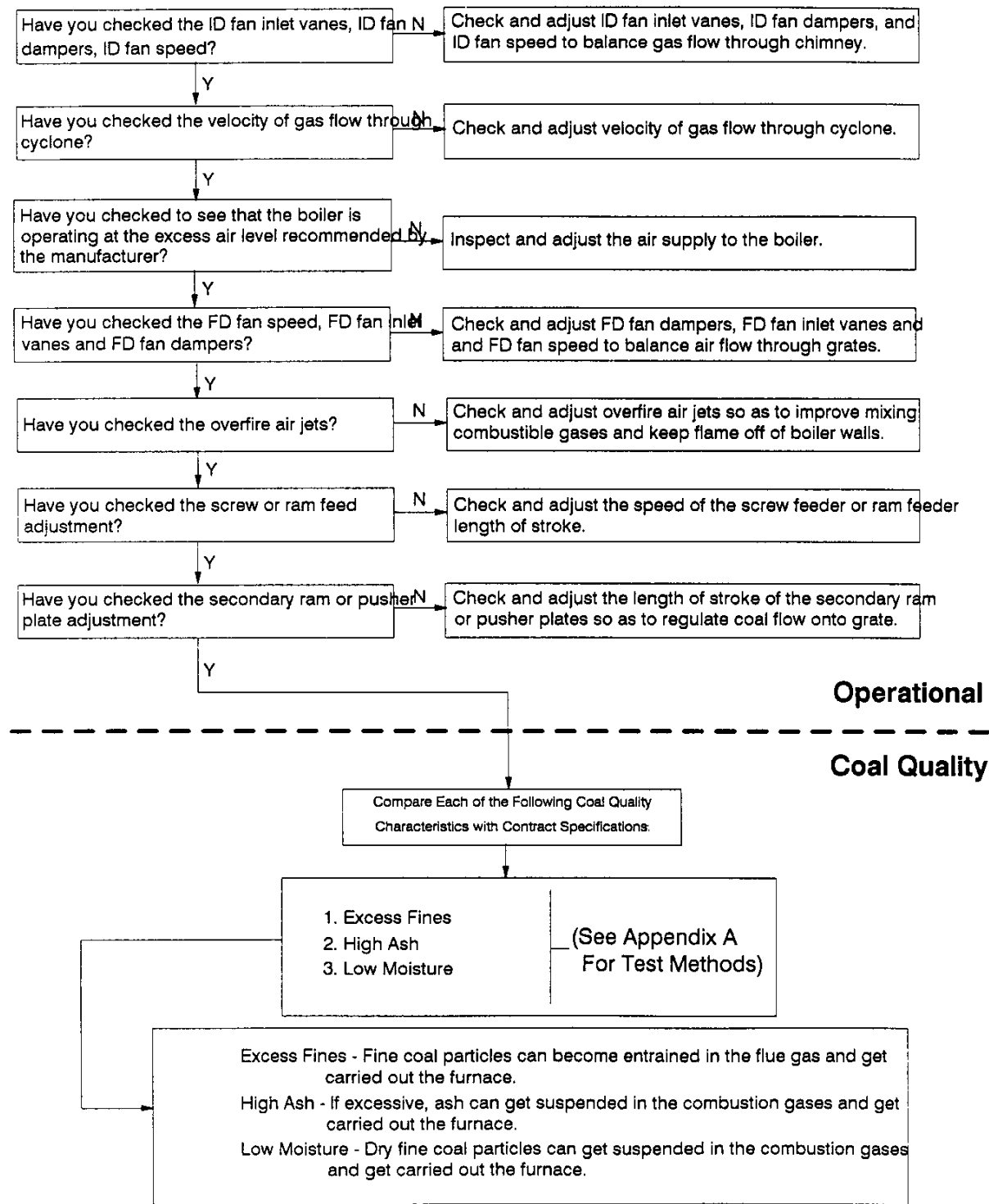
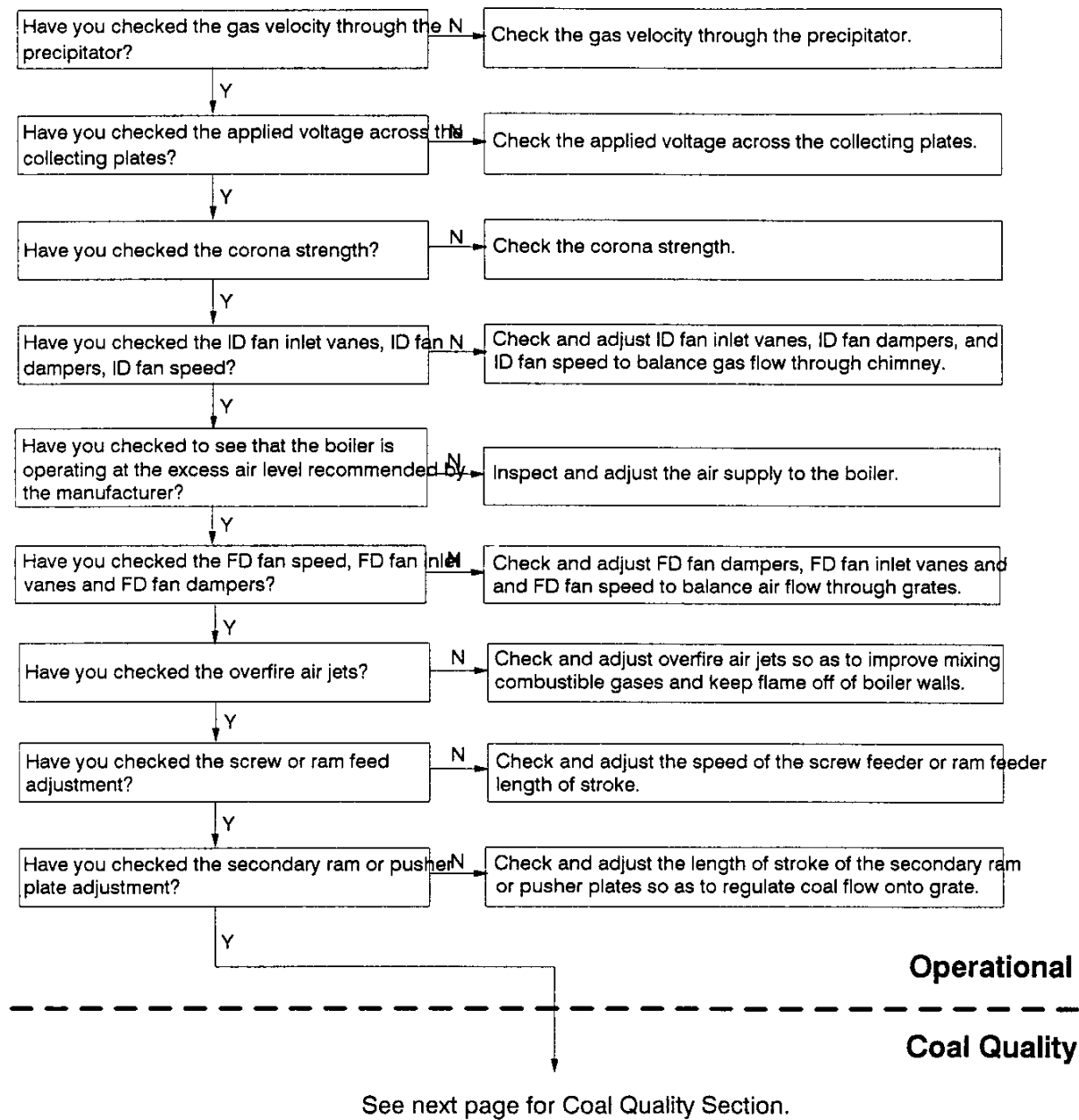
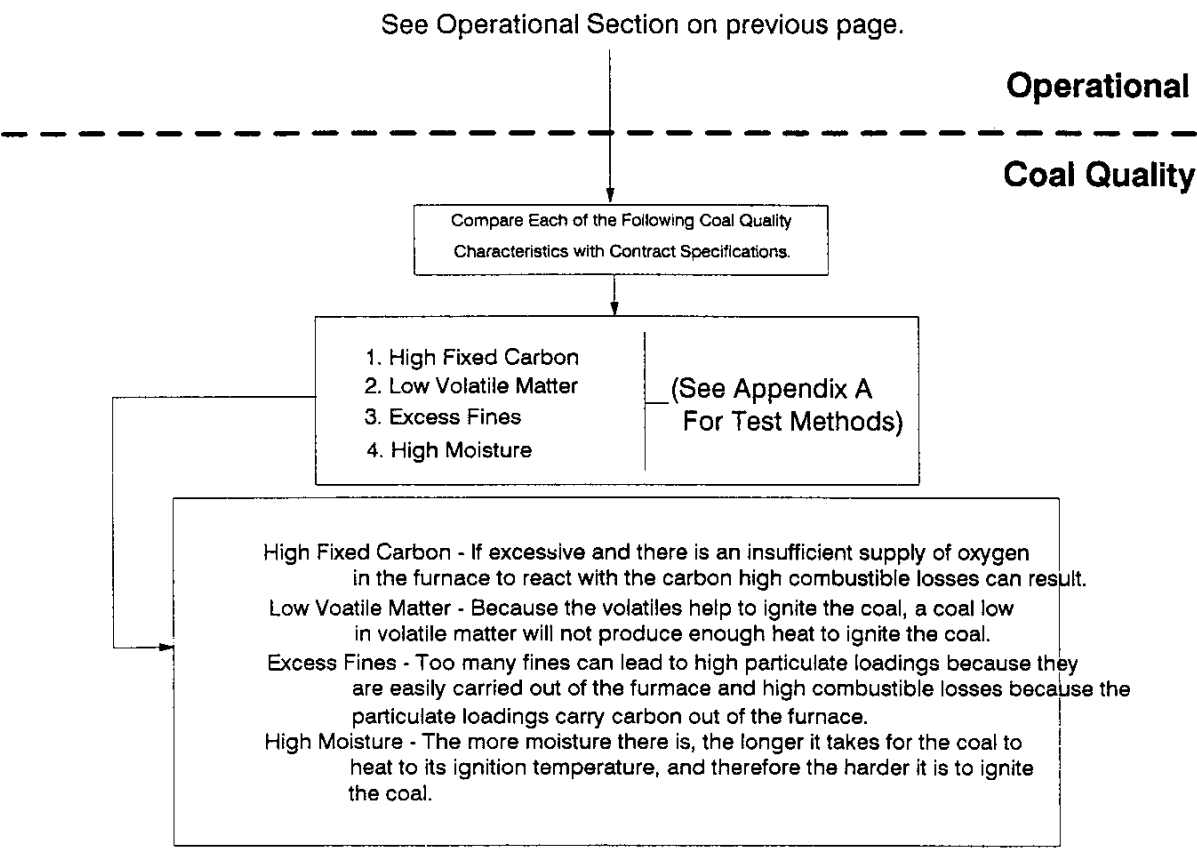


FIG3-86v3

**FIGURE 3-87: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM**  
**For Carbon Burnout From The Particulate Removal System**  
**(Electrostatic Precipitator)**



**FIGURE 3-87 (continued): UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM**  
**For Carbon Burnout From The Particulate Removal System**  
**(Electrostatic Precipitator)**



**FIGURE 3-88: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM**  
**For Erosion Of The Particulate Removal System**  
**(Electrostatic Precipitator)**

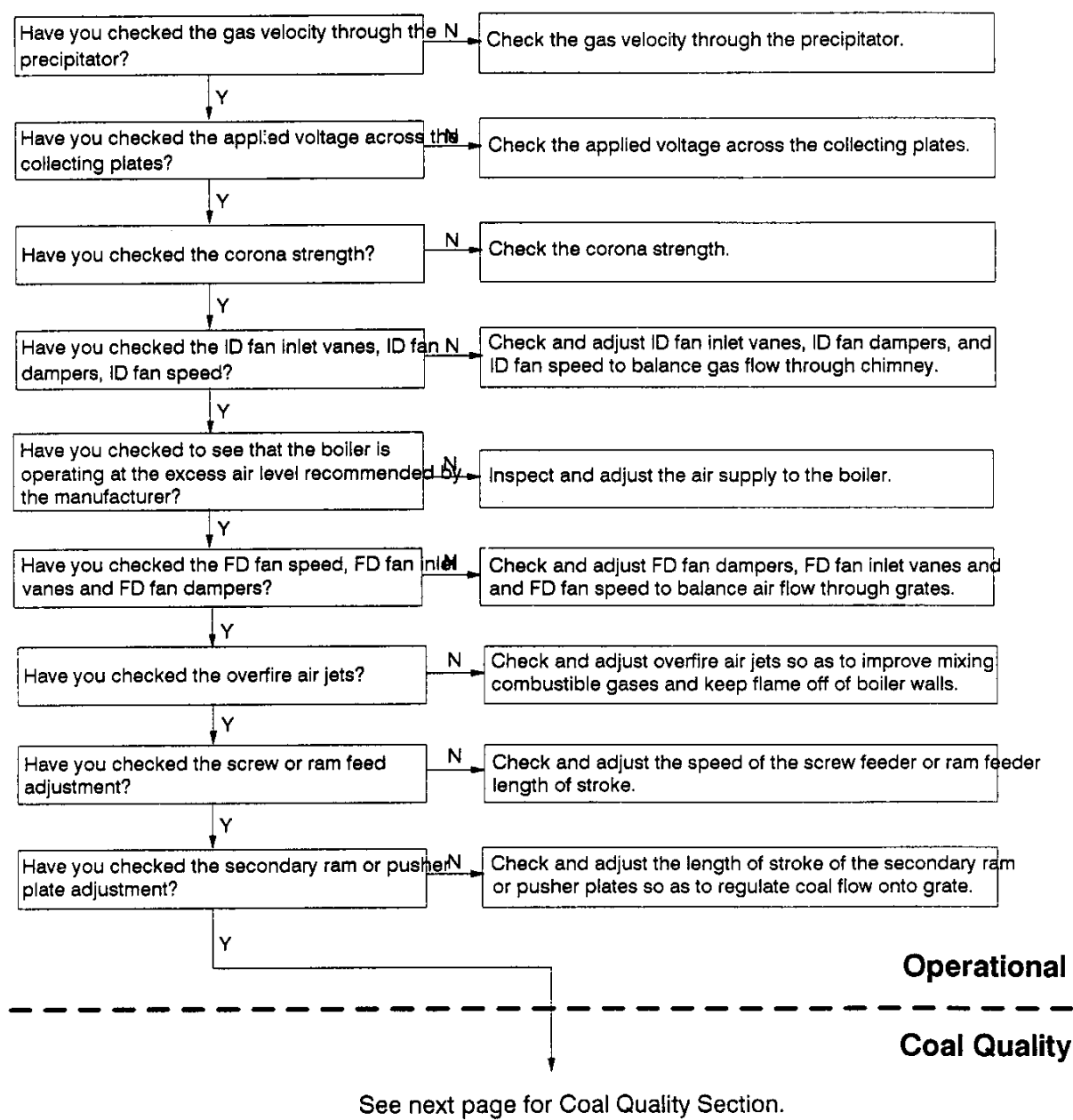
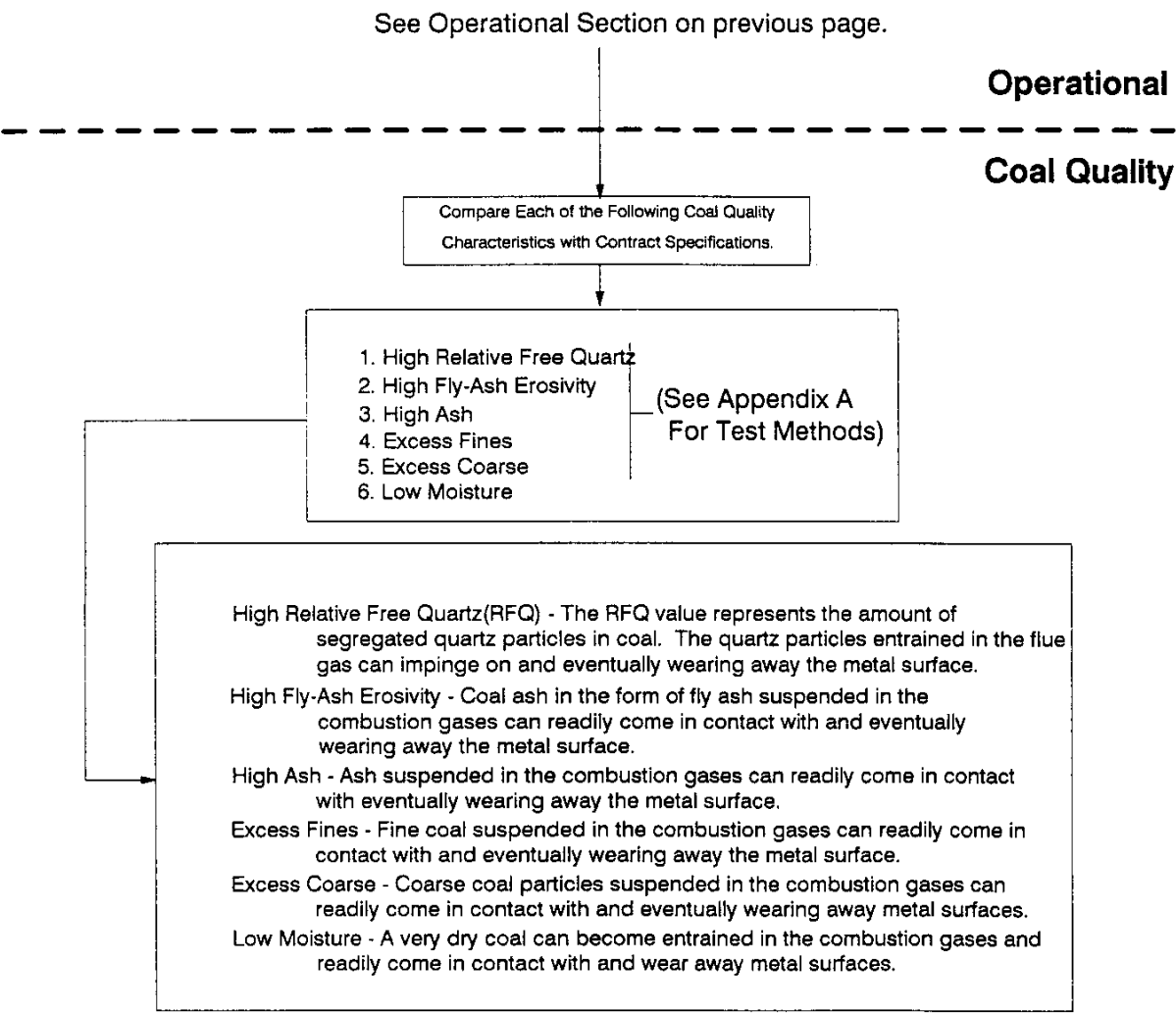
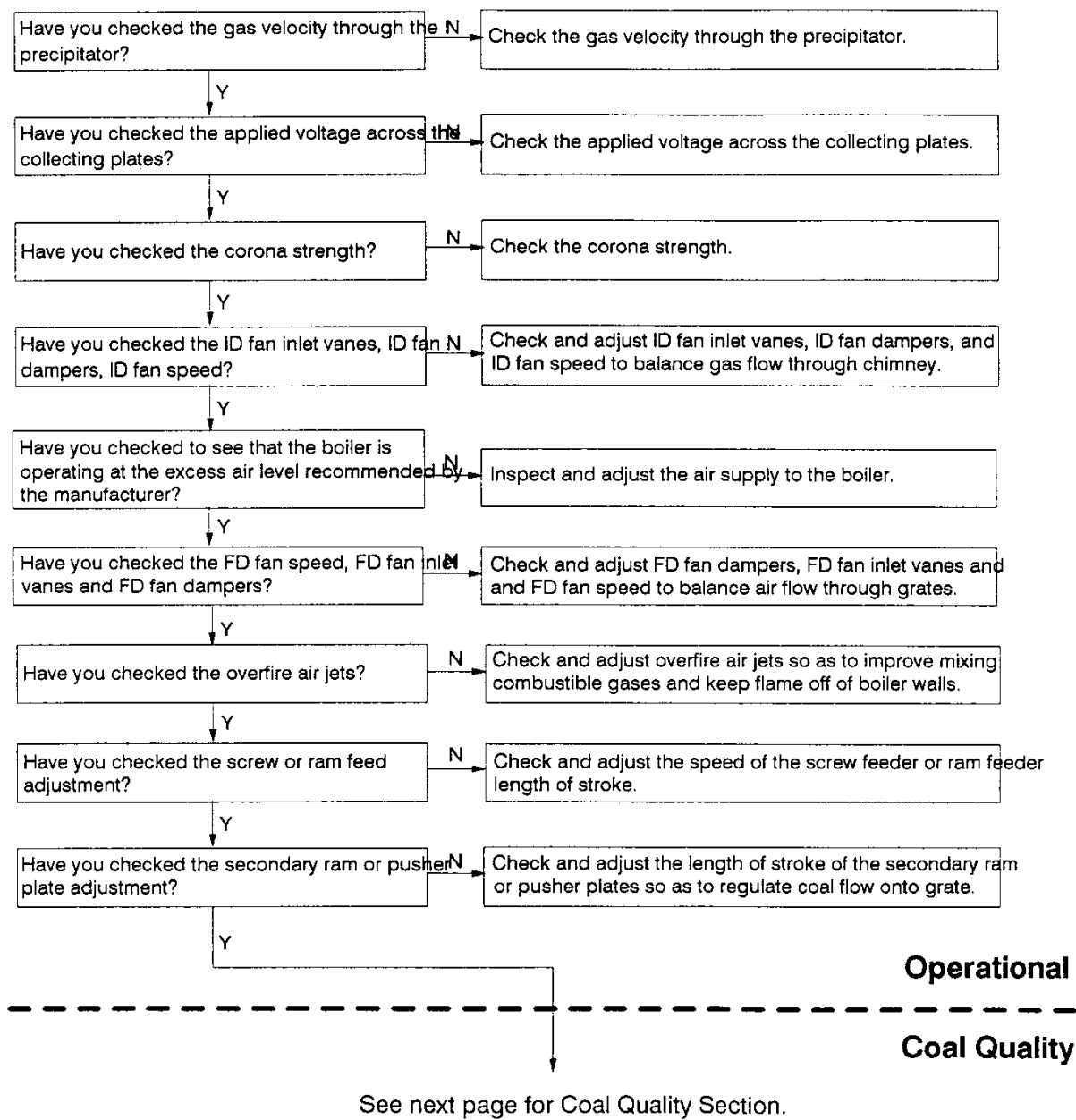


FIGURE 3-88 (continued): UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Erosion Of The Particulate Removal System  
(Electrostatic Precipitator)



**FIGURE 3-89: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM**  
**For Excess Particulate Emissions From The Particulate Removal System**  
**(Electrostatic Precipitator)**





**FIGURE 3-89 (continued): UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM**  
**For Excess Particulate Emissions The Particulate Removal System**  
**(Electrostatic Precipitator)**

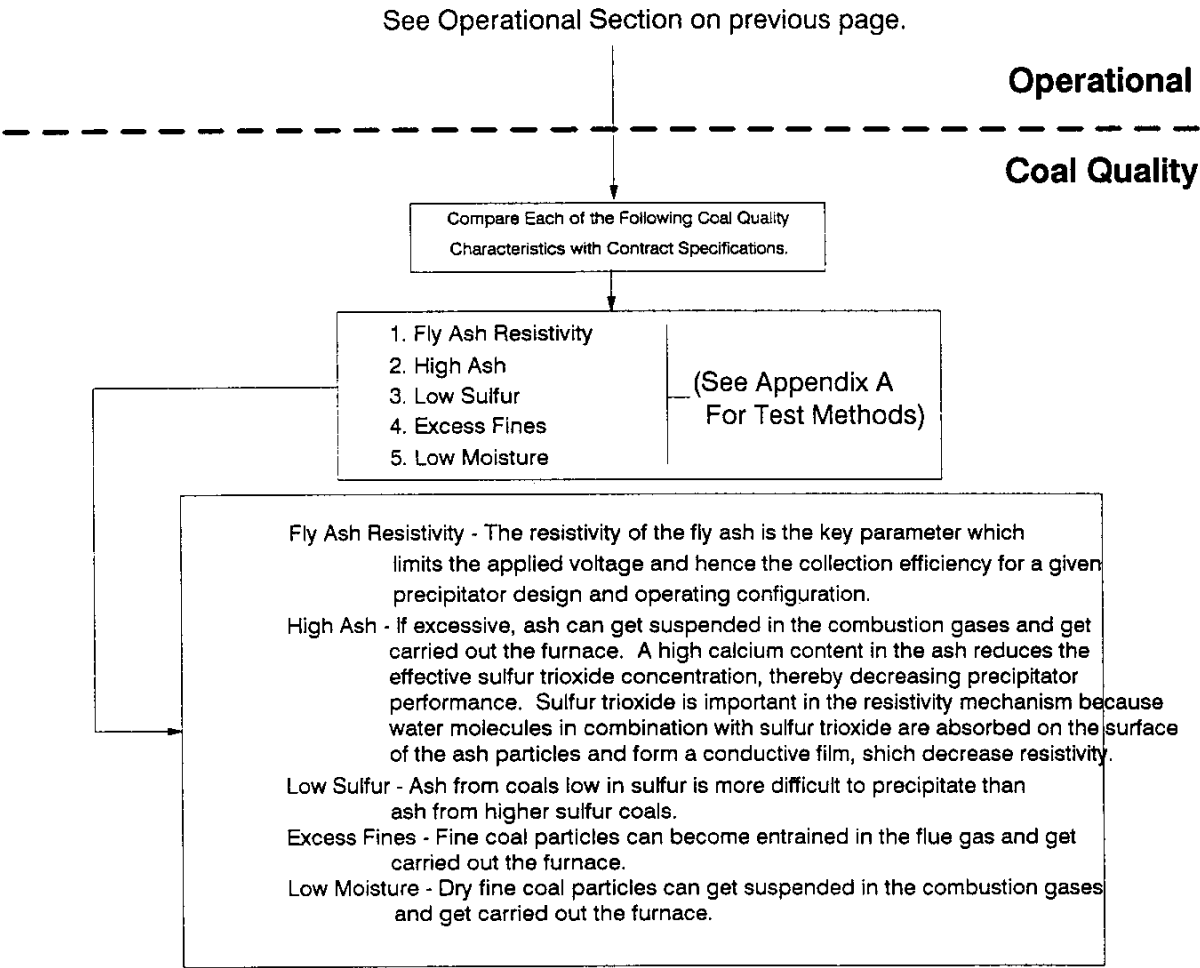


FIG3-89nb/3

**FIGURE 3-90: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM**  
**For Carbon Burnout In The Particulate Removal System**

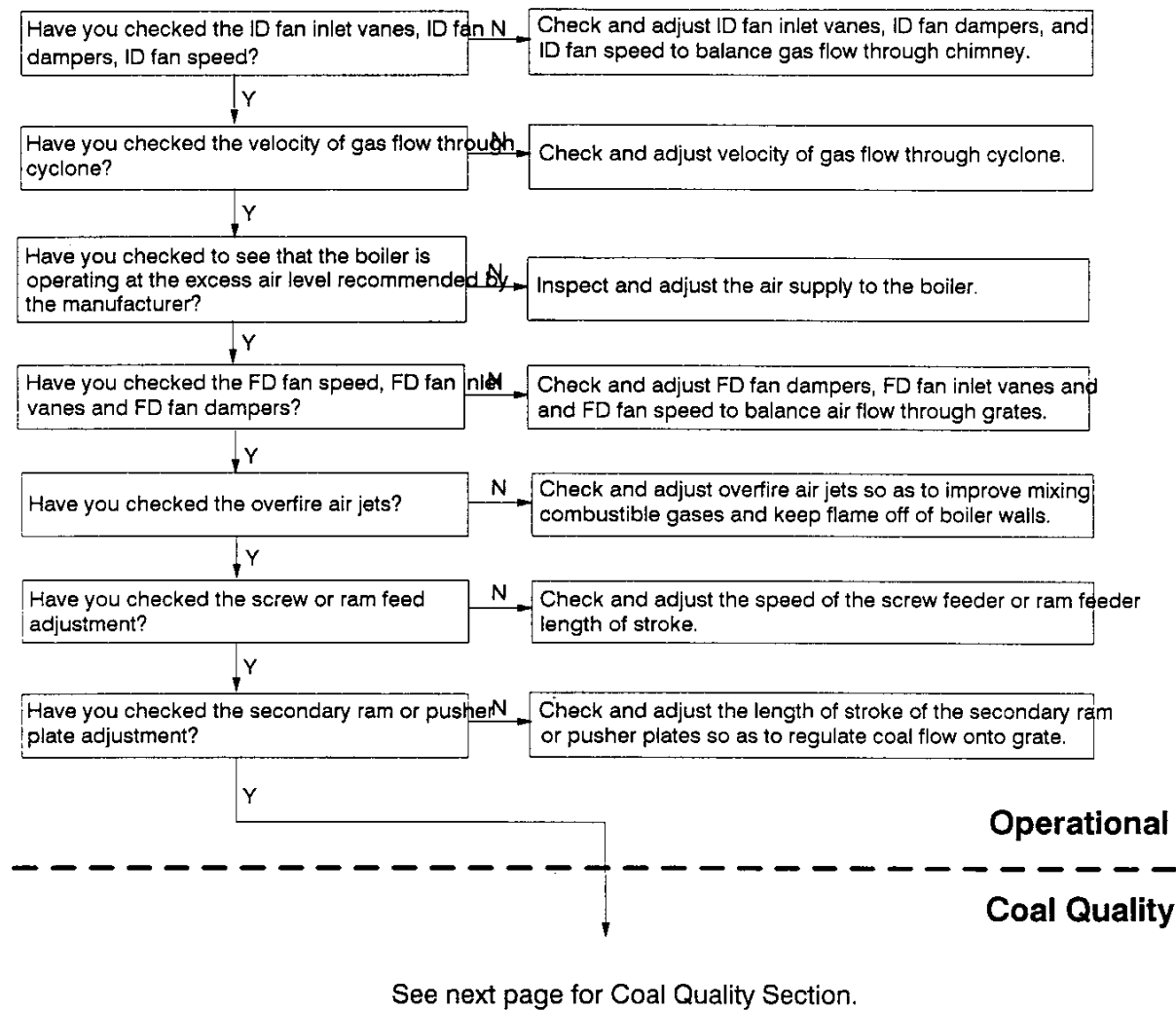


FIGURE 3-90 (continued): UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Carbon Burnout In The Fly-Ash Recycle

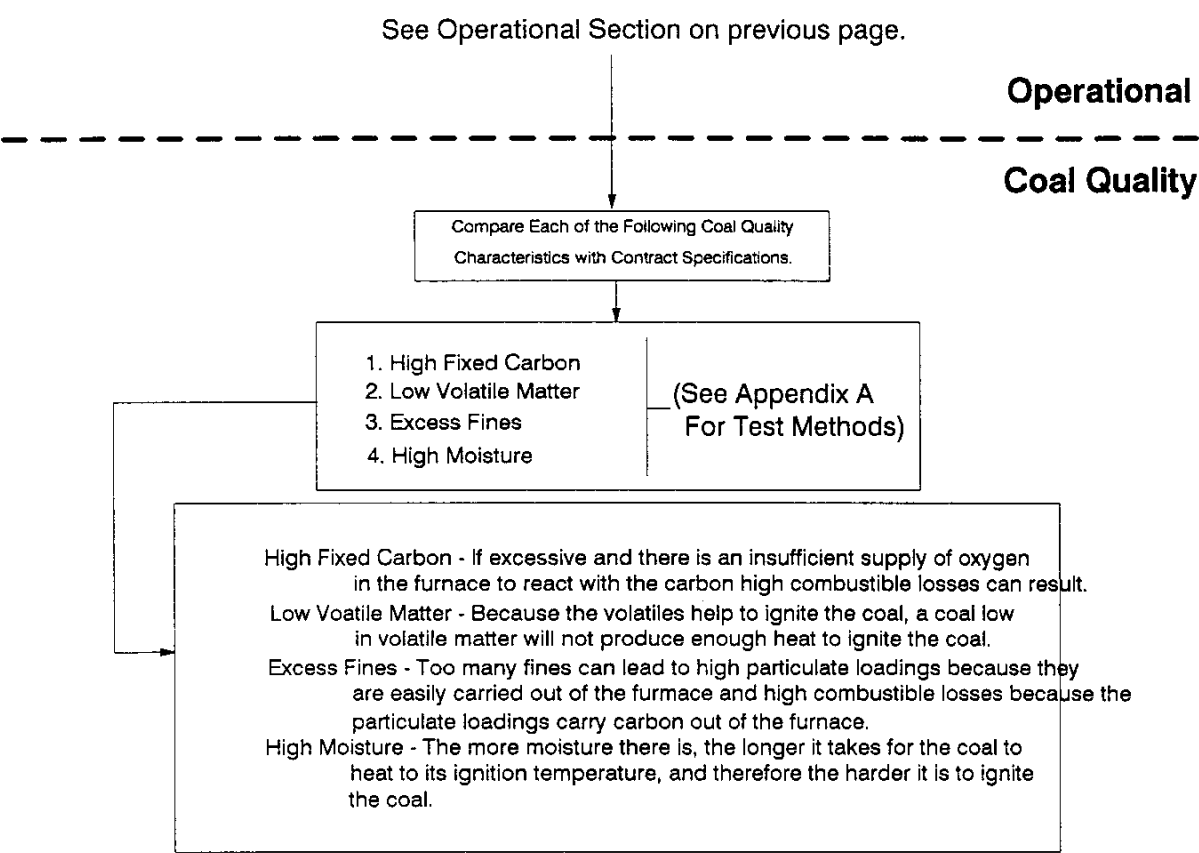


FIGURE 3-91: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Clinkers In The Ash Pit/Hopper

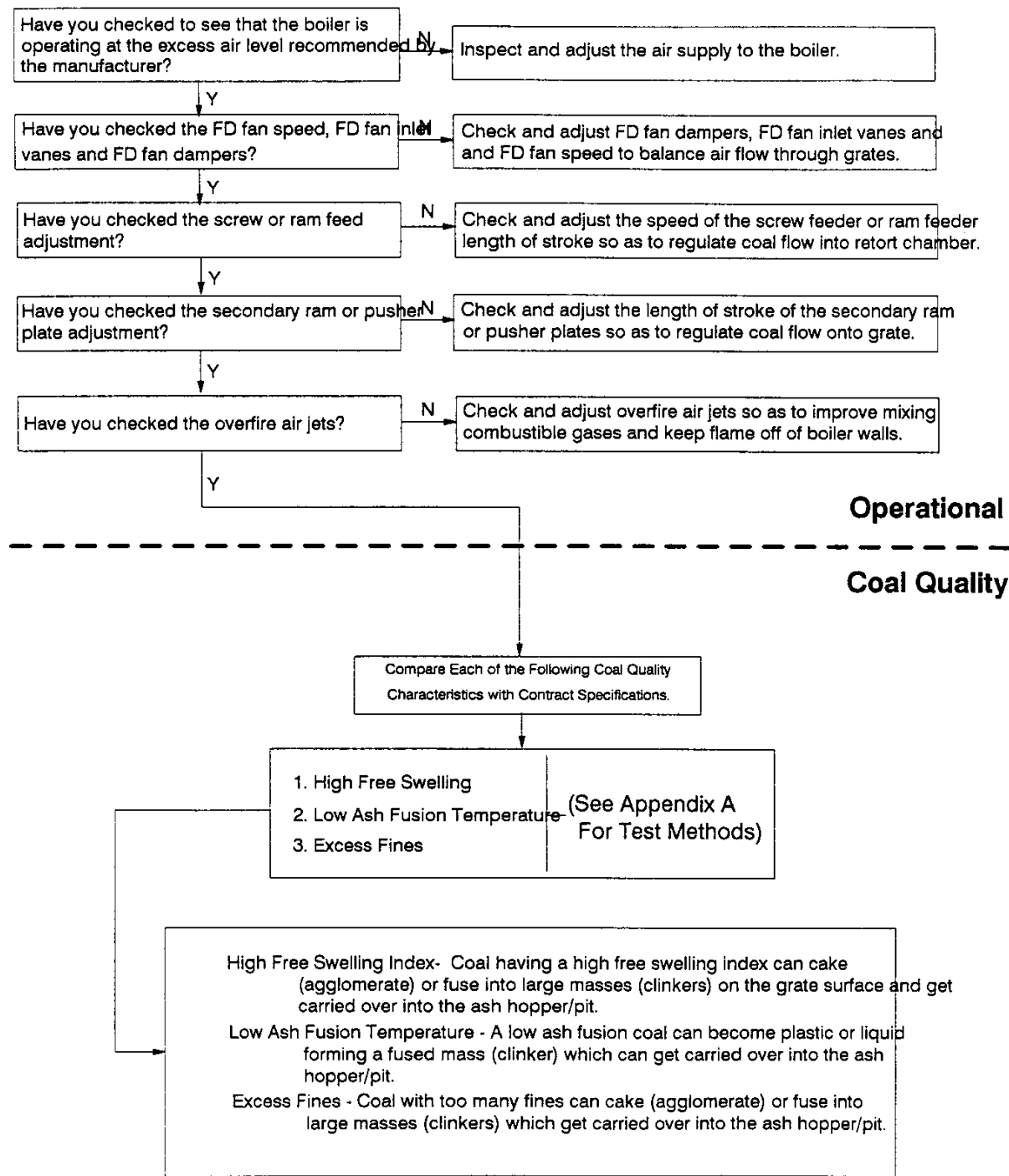


FIG3-91n/2

FIGURE 3-92: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Carbon Burnout In The Ash Pit/Hopper

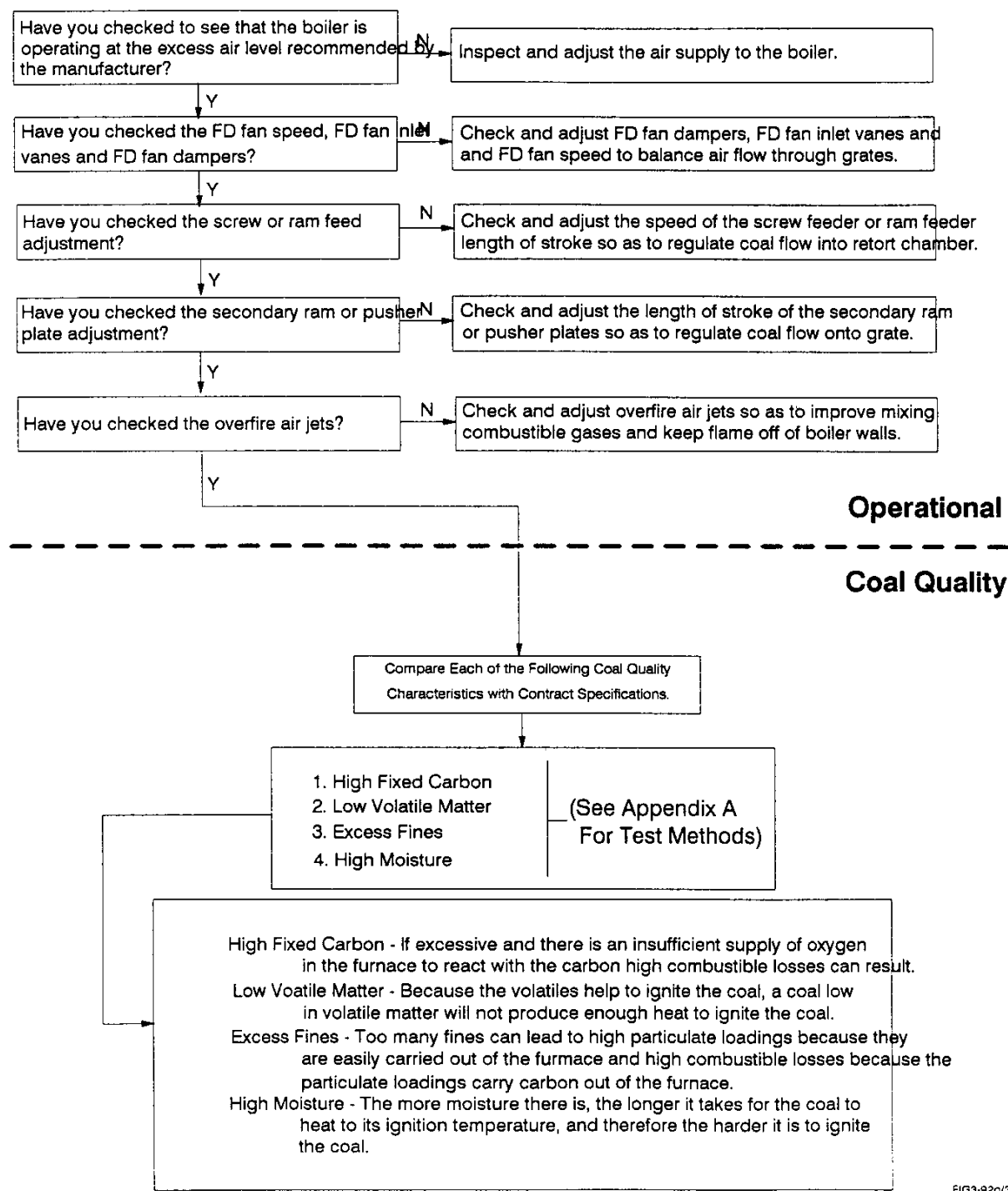


FIG3-92n/3

FIGURE 3-93: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Corrosion Of The Stack/Chimney

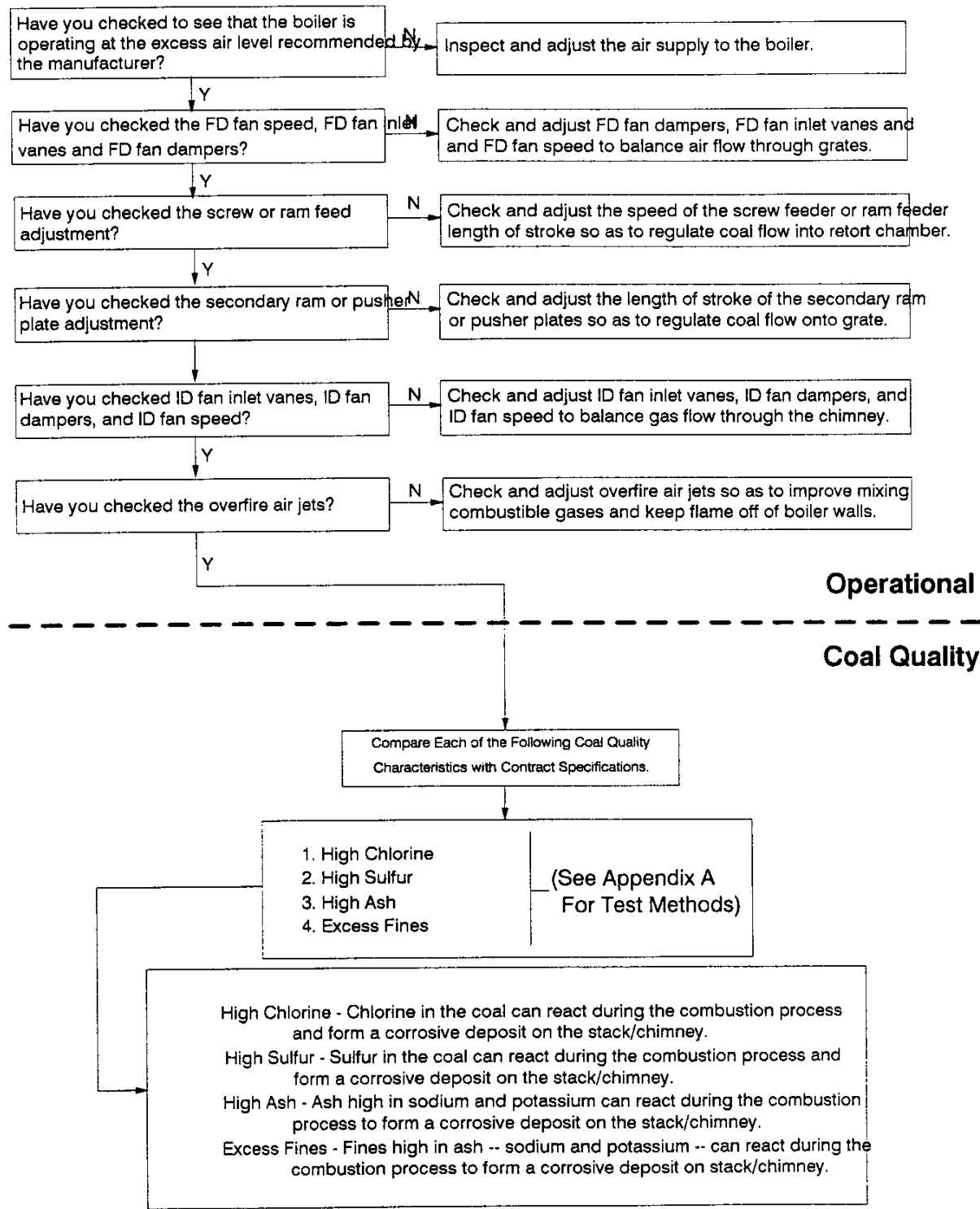


FIG3-93v3

**FIGURE 3-94: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM**  
**For Carbon Burnout In The Stack/Chimney**

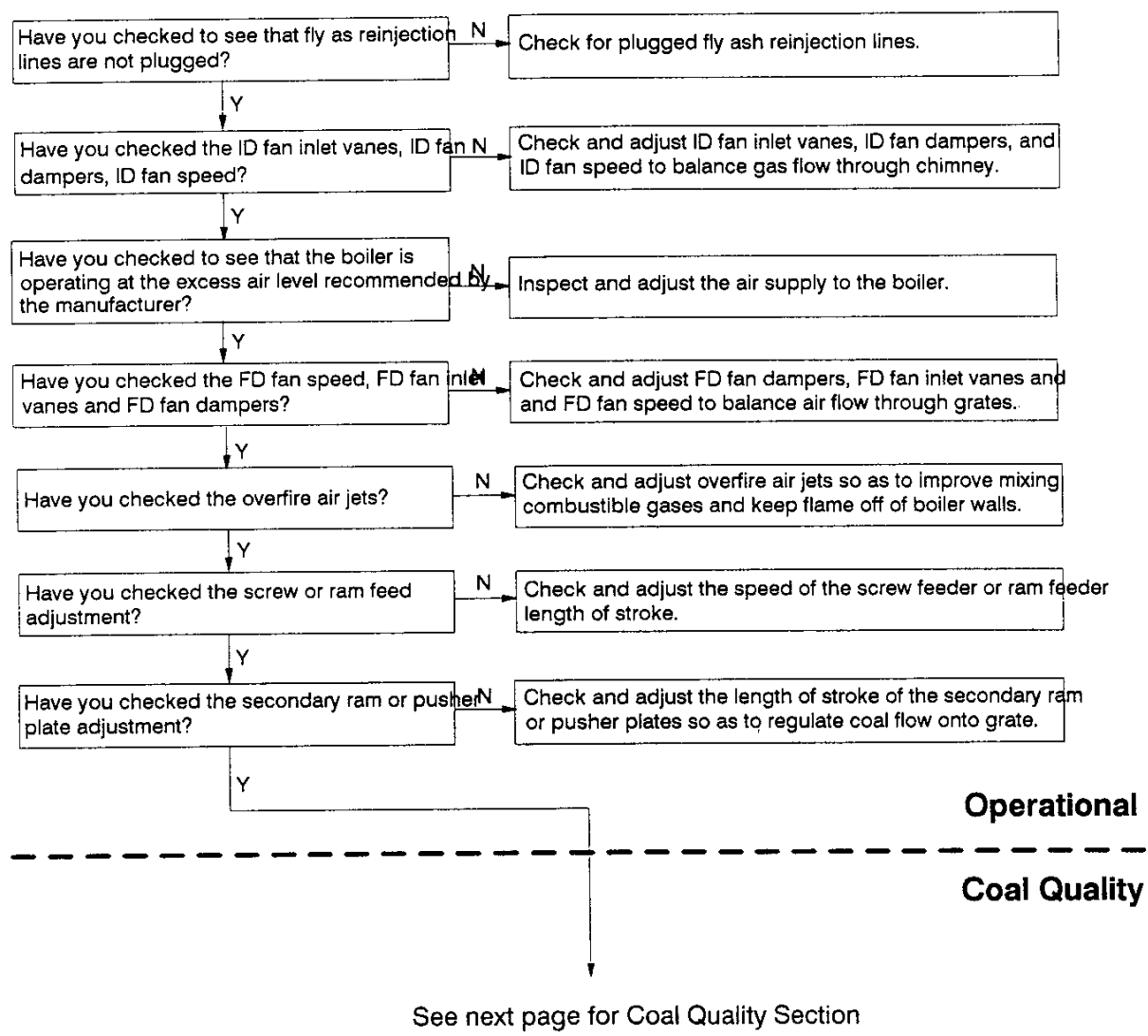


FIG3-94v3

IGURE 3-94 (continued): UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Carbon Burnout In The Stack/Chimney

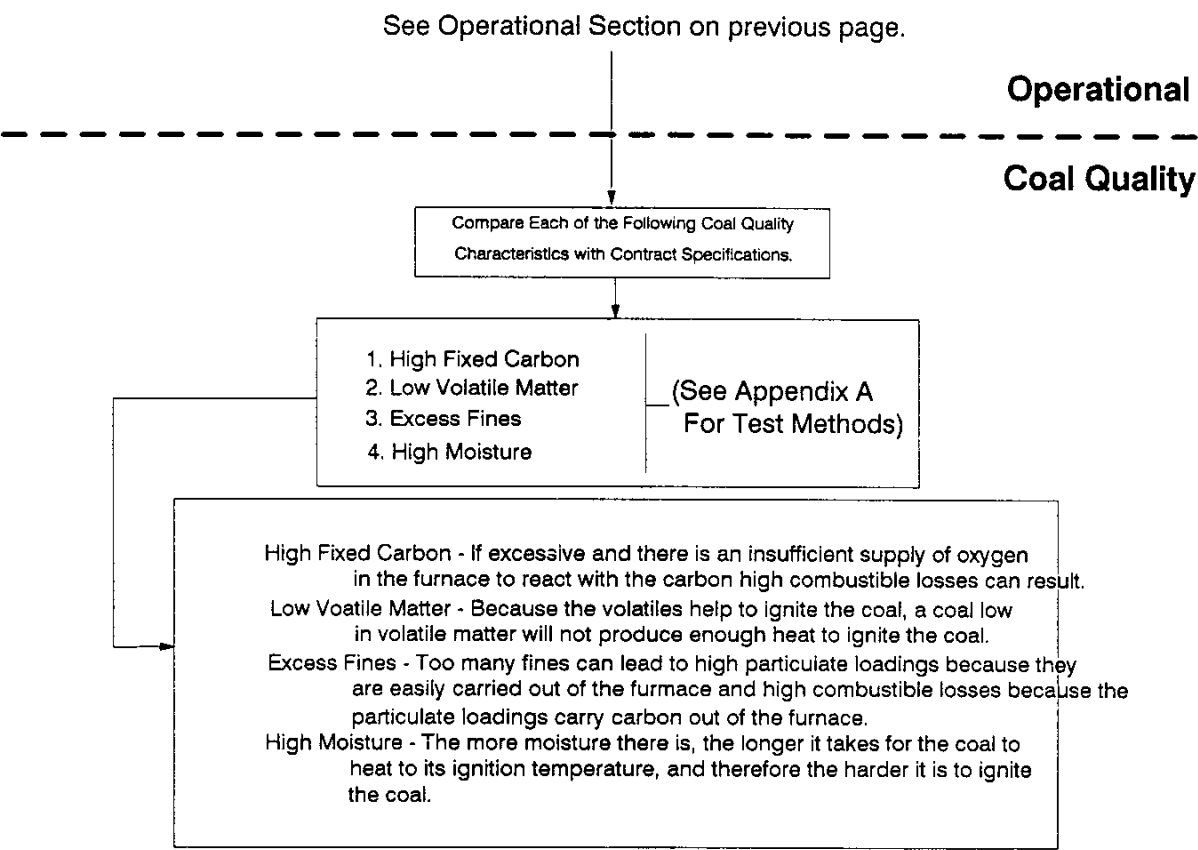




FIGURE 3-95: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Smoking From The Stack/Chimney

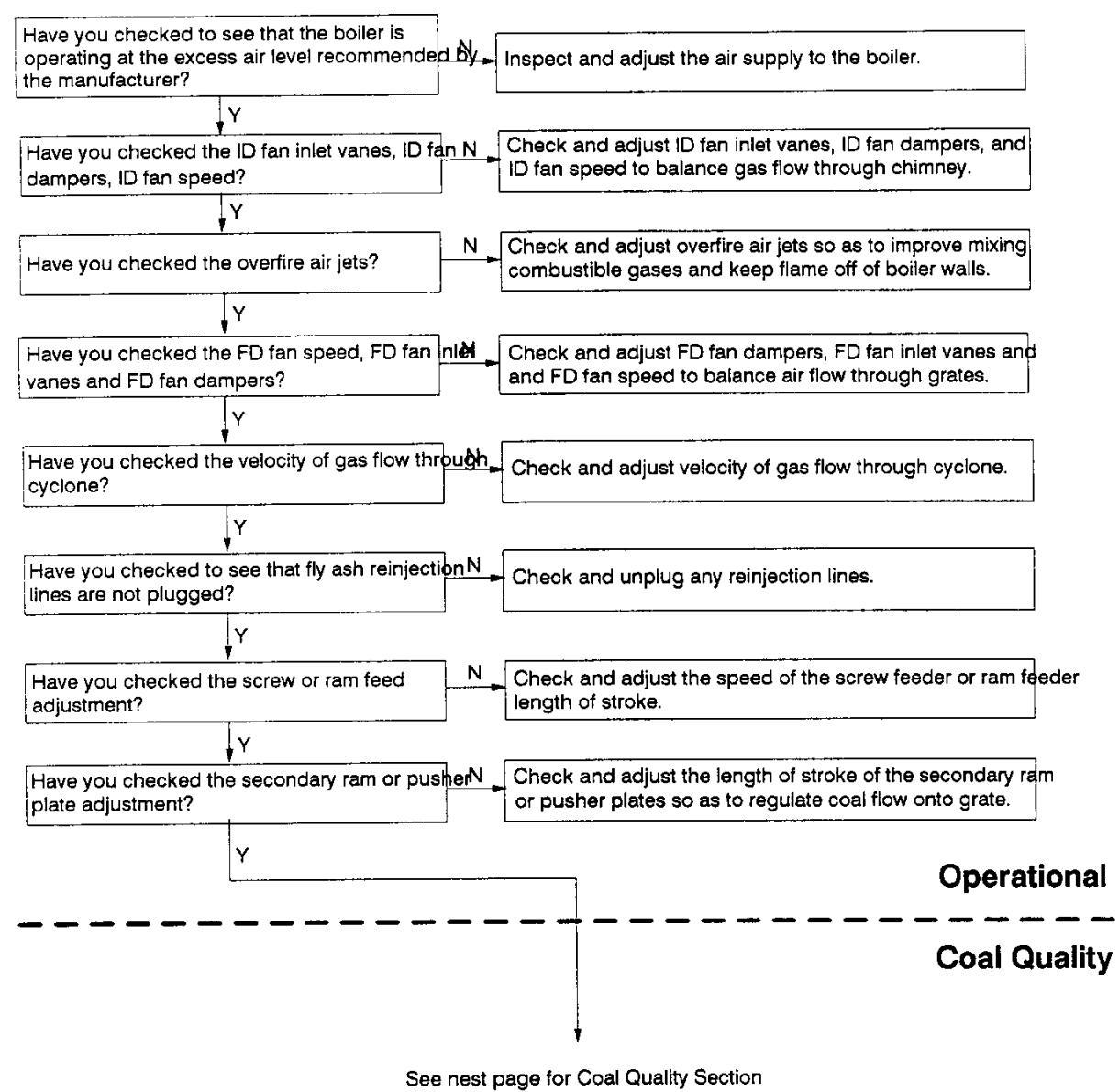
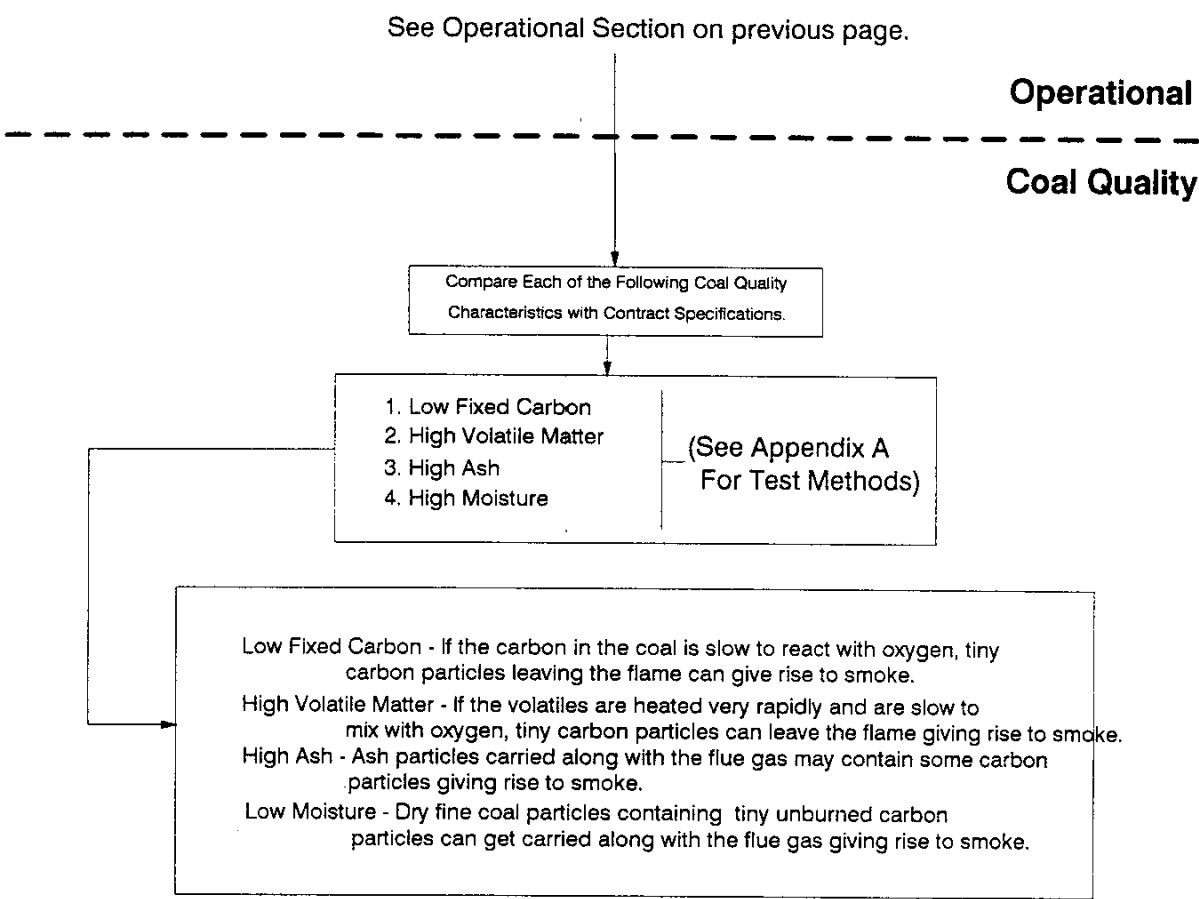


FIGURE 3-95 (continued): UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Smoking From The Stack/Chimney



**FIGURE 3-96: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM**  
**For Excess Particulate Emissions From The Stack/Chimney**

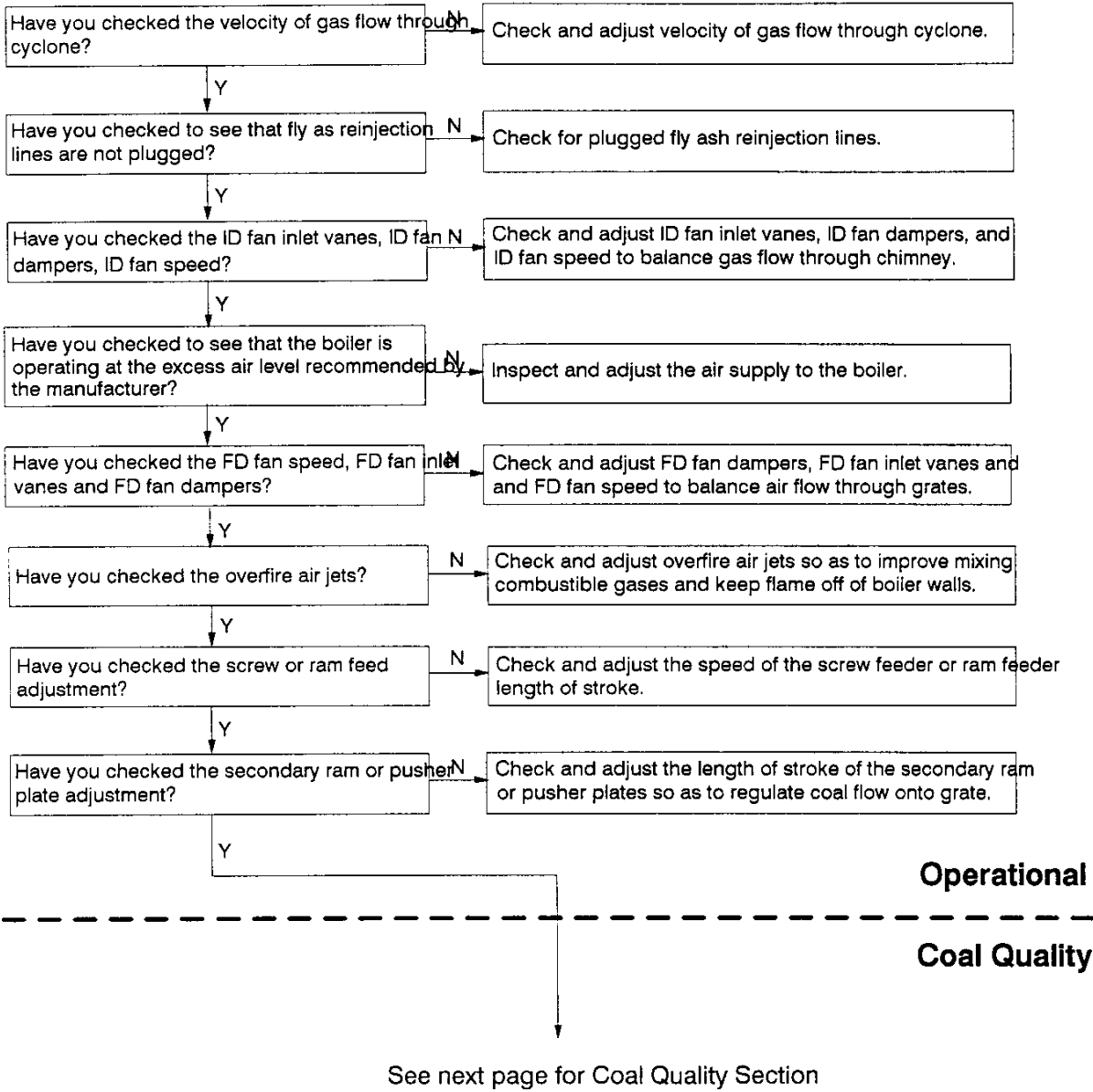


FIGURE 3-96 (continued): UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For Excess Particulate Emissions From The Stack/Chimney

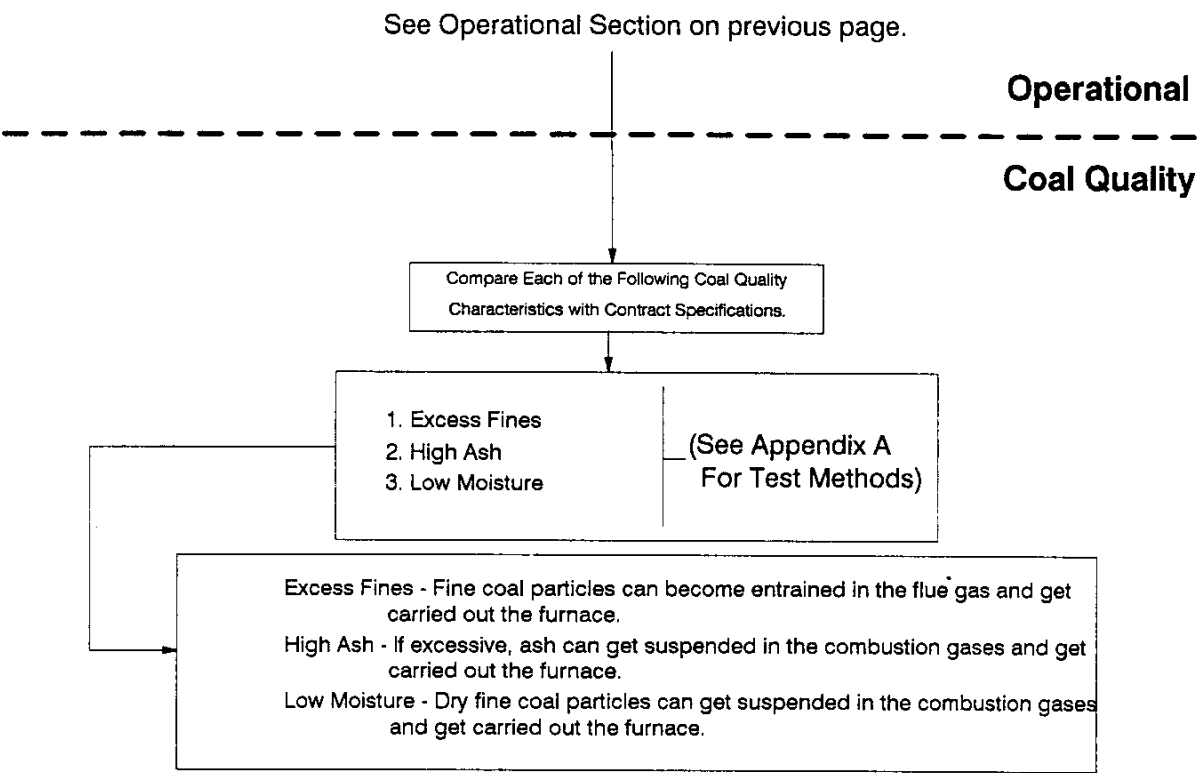


FIGURE 3-97: UNDERFEED STOKER TROUBLESHOOTING LOGIC DIAGRAM  
For SO<sub>2</sub> Emissions From The Stack/Chimney

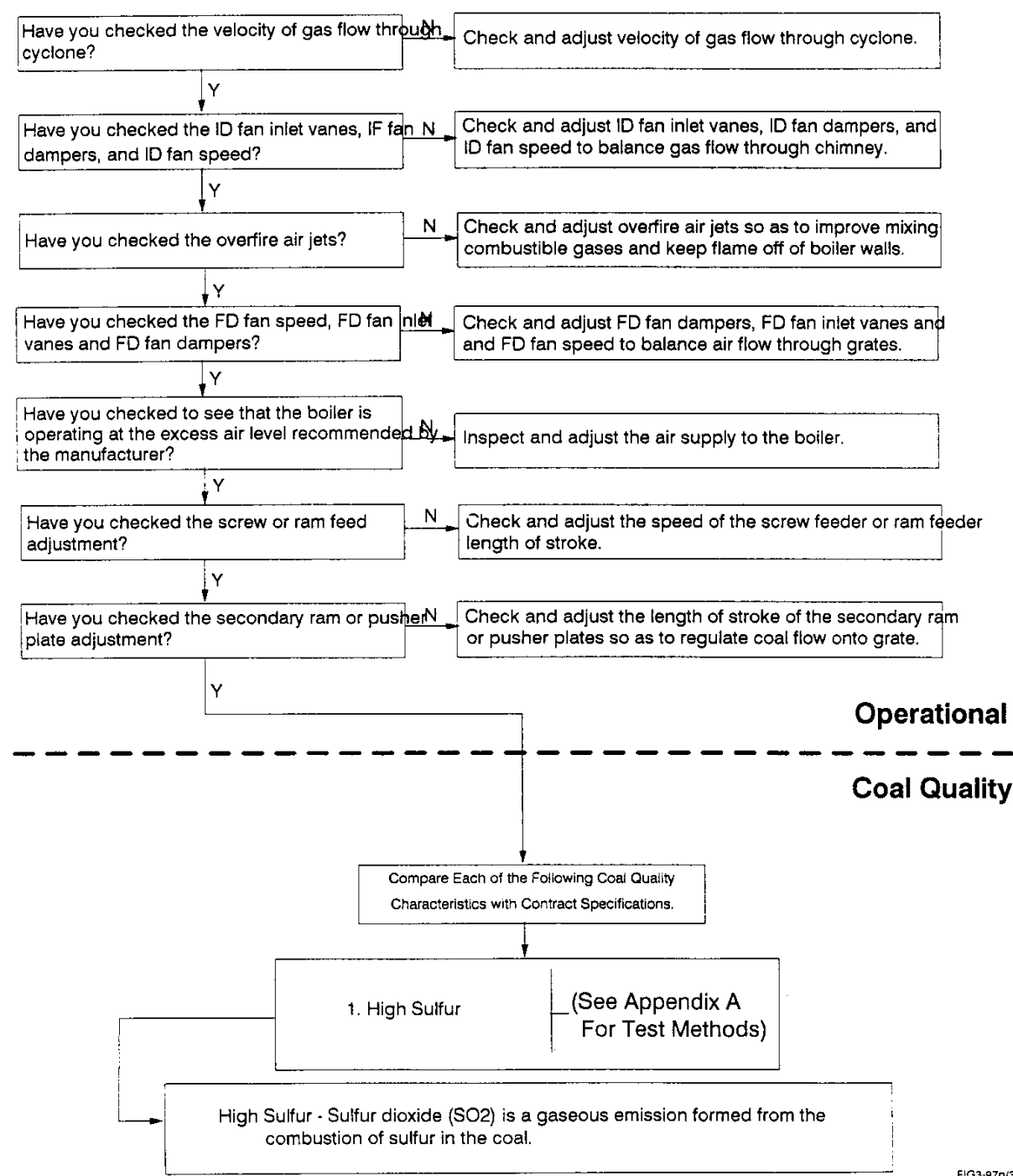


FIG3-97n/3

